Cooperative Forestry & Pest Management

United States
Department of
Agriculture

Forest
Service

Northern
Region

State &
Private
Forestry

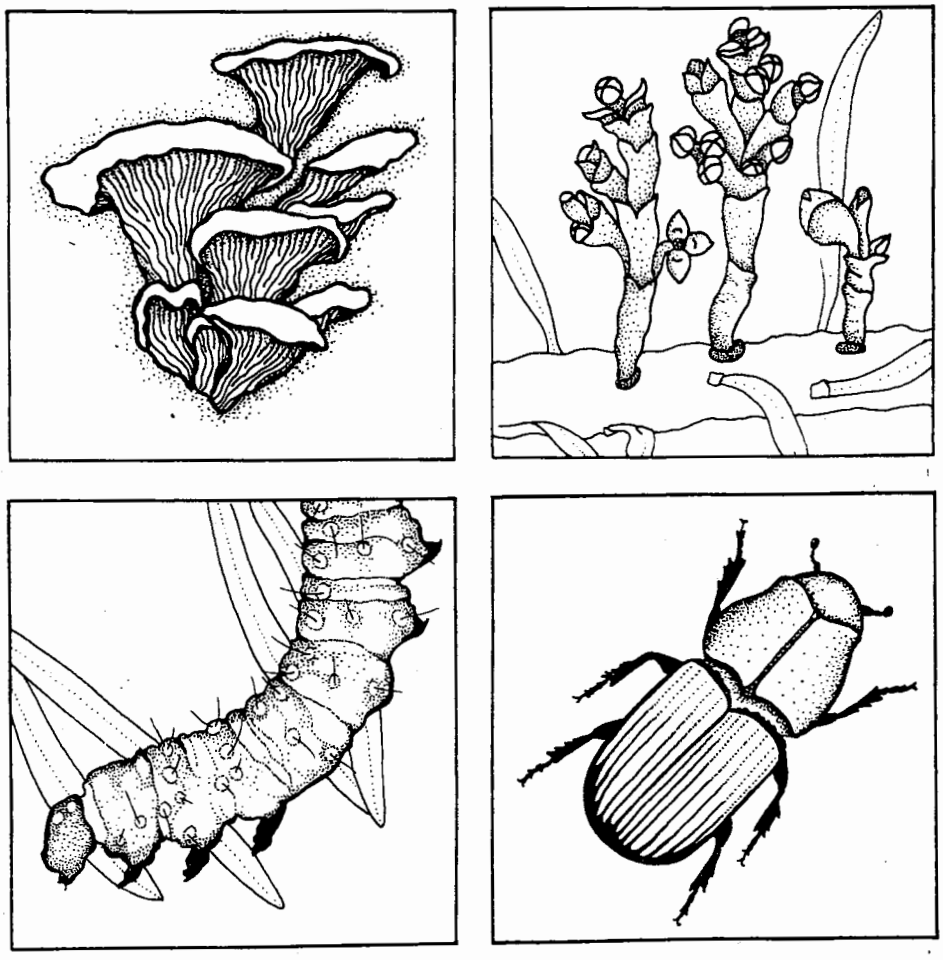
Report No. 83-16

June 1983

STATUS OF MOUNTAIN PINE BEETLE, NORTHERN REGION, 1982

by

M. D. McGregor
R. D. Oakes
H. E. Meyer



STATUS OF MOUNTAIN PINE BEETLE, NORTHERN REGION, 1982

by

M. D. McGregor, R. D. Oakes, and H. E. Meyer

Lodgepole pine forests of the Northern Region are experiencing the most devastating epidemic infestations of mountain pine beetle in recorded history.

The first reported outbreak in the Northern Rocky Mountains occurred on the Flathead National Forest in 1909 (Evenden 1944). In 1911, the Beaverhead National Forest in southwestern Montana experienced its first reported epidemic on the west side of the Big Hole Basin (Evenden and Gibson 1940). This epidemic spread over 1.3 million acres, killing about 57,756,000 trees larger than 3 inches in diameter from 1925 through 1936. Total mortality of merchantable trees 9 inches d.b.h. is estimated to be 77.3 percent of the original stands. During the early 1900's, more than 3.5 million trees containing 280 MMBF were killed in Flathead County (Evenden 1944). Between 1911 and 1937, infestations developed, devastated stands, and subsided on the Kootenai, Deerlodge, Lolo, and Bitterroot National Forests.

A large portion of the lodgepole pine forests of the Northern Region was born of fire and, in the succession of plants in these ecosystems, fire plays an important role. Short-lived species, like lodgepole pine, demonstrate fire's role very well. In many lodgepole pine stands, underburns have resulted in understory thinning, thus reducing tree competition and possibly increasing growth allowing residual trees to develop d.b.h.'s with thick phloem conducive to the present epidemic. Other fires may have precluded outbreak development in some areas by causing total stand replacement. The existence of thousands of acres of fairly recently underburned lodgepole pine, combined with little opportunity for extensive stand-replacing fires, has apparently provided the opportunity for epidemic development (Barrett & Kilgore 1983). The mountain pine beetle fits the pattern because it attacks the pine toward the end of the tree's life cycle. Following a mountain pine beetle epidemic, the buildup of fuel greatly increases the risk of stand-replacement fires.

Currently, infestations are building enormous fuel beds that in time will burn unless fuel treatment occurs. The Sleeping Child Fire of 1961 in Montana, which caused an enormous amount of resource loss, occurred about 30 years following a large-scale mountain pine beetle outbreak. The North Fork of the Flathead River, including the west side of Glacier National Park; the Gallatin River Canyon; and portions of Yellowstone National Park are examples of vast fuel beds that have been created recently by mountain pine beetle epidemics (McGregor 1982; Canada-U.S. Mountain Pine Beetle Executive Summary 1983).

Protection capabilities are geared to normal fire and fuel situations. When fuel beds occur, such as those now being created by mountain pine beetle, protection forces are taxed.

Burning conditions now are classed as moderate in most of the lodgepole pine type. Fire incidence and burned acreage during the past 10 years have been low. However, as infestations intensify, an increase in the incidence of large, intense fires is inevitable in these stands.

Although fire will reduce lodgepole pine fuel, it will probably spread into other timber stands. With fuels of this magnitude, large areas are likely to burn, causing watershed, soil, wildlife, and other associated impacts (Canada-U.S. Mountain Pine Beetle Executive Summary 1983).

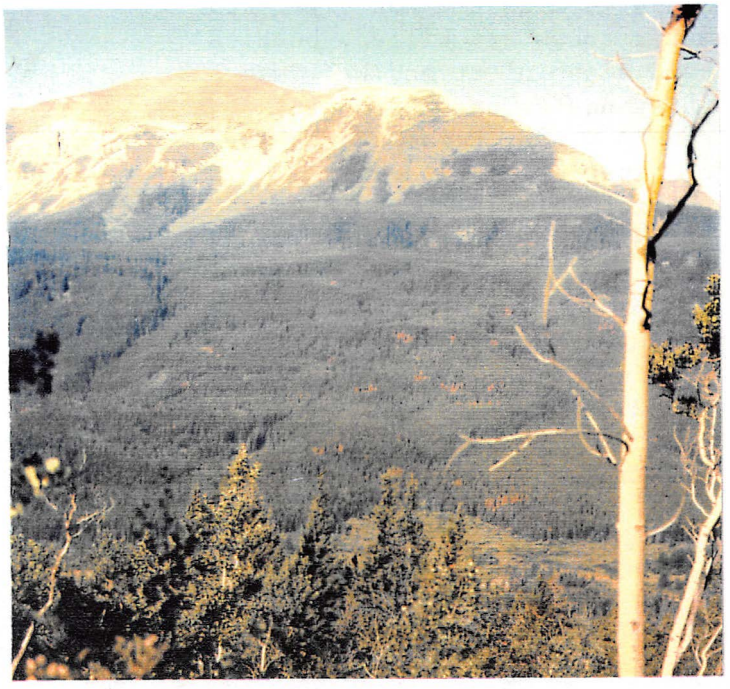
The current infestations began and developed to epidemic levels in high hazard lodgepole pine stands on the Gallatin National Forest in 1969; Beaverhead and Kootenai National Forests in 1972; Lolo National Forest in 1973; Flathead National Forest in 1974; Glacier National Park in 1972; and Yellowstone National Park in 1966. Beetle populations have continued to increase yearly. Epidemic infestations now extend over 2.1 million acres of Federal, State, and private forested lands in the Northern Region.

Although the majority of infestation occurs in high hazard lodgepole pine stands (those with lodgepole pine more than 80 years old and which average 8 inches d.b.h. and greater), beetle populations are also infesting adjacent moderate and low hazard stands. Even though some beetles successfully attack smaller diameter lodgepole pine trees (<7 inches d.b.h.), phloem is thin, dries rapidly, and mortality of developing broods is high. Consequently, few beetles mature and emerge. Following initial mountain pine beetle attack, these small-diameter trees are usually attacked and killed by secondary bark beetles (Pityogenes spp; Pityophthorous spp; and Ips spp).

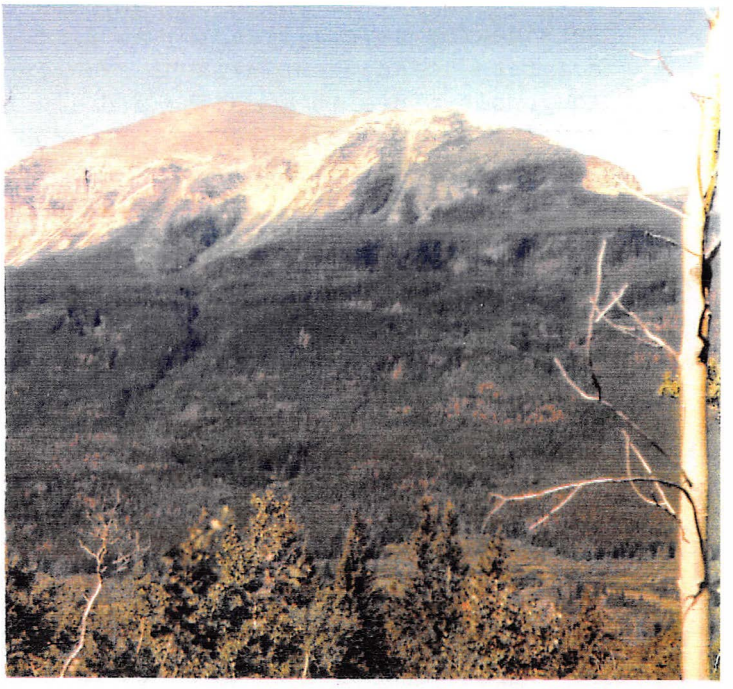
In addition to lodgepole pine, extensive mortality has occurred on 27,250 acres of high elevation whitebark pine type; 116,600 acres of ponderosa pine type, and 5,000 acres of western white pine type. Occasional mortality of Engelmann spruce has occurred in Glacier National Park and in the Gallatin National Forest due to high beetle populations.

Infestations persist for various periods ranging from 6 to 10 years. Duration of epidemics is dependent on the diameter and age distribution of susceptible hosts in the stands. In nearly pure stands where 80 percent of the lodgepole pine is >8 inches d.b.h. and >80 years old, trees will probably be killed in a 4- to 5-year period. This is typical of the infestation in the North Fork Flathead River drainage, McGregor Lake, and in Glacier National Park (fig. 1).

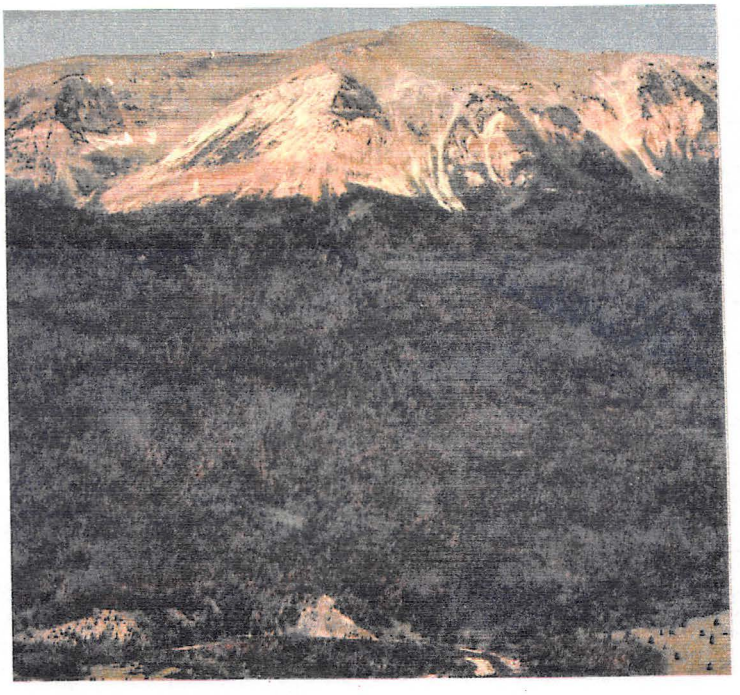
Other epidemics can persist for 8-10 years, with considerable mortality occurring in smaller diameter trees. This second situation is typical of infested stands on the Gallatin National Forest, particularly at West Yellowstone.



A - 1979



B - 1980



C - 1981

D - 1982

Figure 1.--Typical infestation, depicting progression and mortality of susceptible hosts in a 4- to 5-year period, Flathead National Forest and Glacier National Park, Montana.

Since considerable acreage of susceptible host still exists in many forests of the Northern Region, the current epidemics are not likely to subside for several years. As large diameter trees are killed, beetles emigrate to adjacent high hazard stands, and also infest and kill many lodgepole pines in moderate and low hazard stands. The possibility of a decline of the current outbreaks due to severe winter temperatures is improbable, particularly from temperatures experienced this winter. If it does occur, it will probably be confined to cooler pockets in some drainages. However, where susceptible stands exist, beetle populations can rebound rapidly.

Results of aerial and ground surveys estimate 92,895,000 lodgepole pine containing 7.4 billion bd. ft. of merchantable volume have been killed over 2.3 million acres from 1969 through 1982 (table 1).

Table 1.--Area and number of lodgepole pine killed by mountain pine beetle in Montana, 1969-1982.

Year	Acres infested	Lodgepole pine killed/year	Cumulative number of LPP killed
1969	86,000	173,257	173,257
1970	155,420	255,606	428,863
1971	498,860	605,606	1,034,469
1972	692,430	1,244,090	2,278,559
1973	843,680	1,398,217	3,676,776
1974	952,524	2,175,209	5,851,985
1975	945,912	1,747,803	7,599,788
1976	895,709	7,614,941	15,214,729
1977	569,235	17,851,552	33,066,281
1978	781,144	11,627,359	44,693,640
1979	1,366,496	9,900,000	54,593,640
1980	2,129,953	23,583,713	78,177,353
1981	2,322,437	8,617,915	86,795,268
1982	1,900,000	6,000,000	92,795,268

Predicted acres of infestation and lodgepole pine mortality are shown in figures 2 and 2A.

FIGURE 2

LODGEPOLE PINE MORTALITY CAUSED BY MPB
IN MONTANA

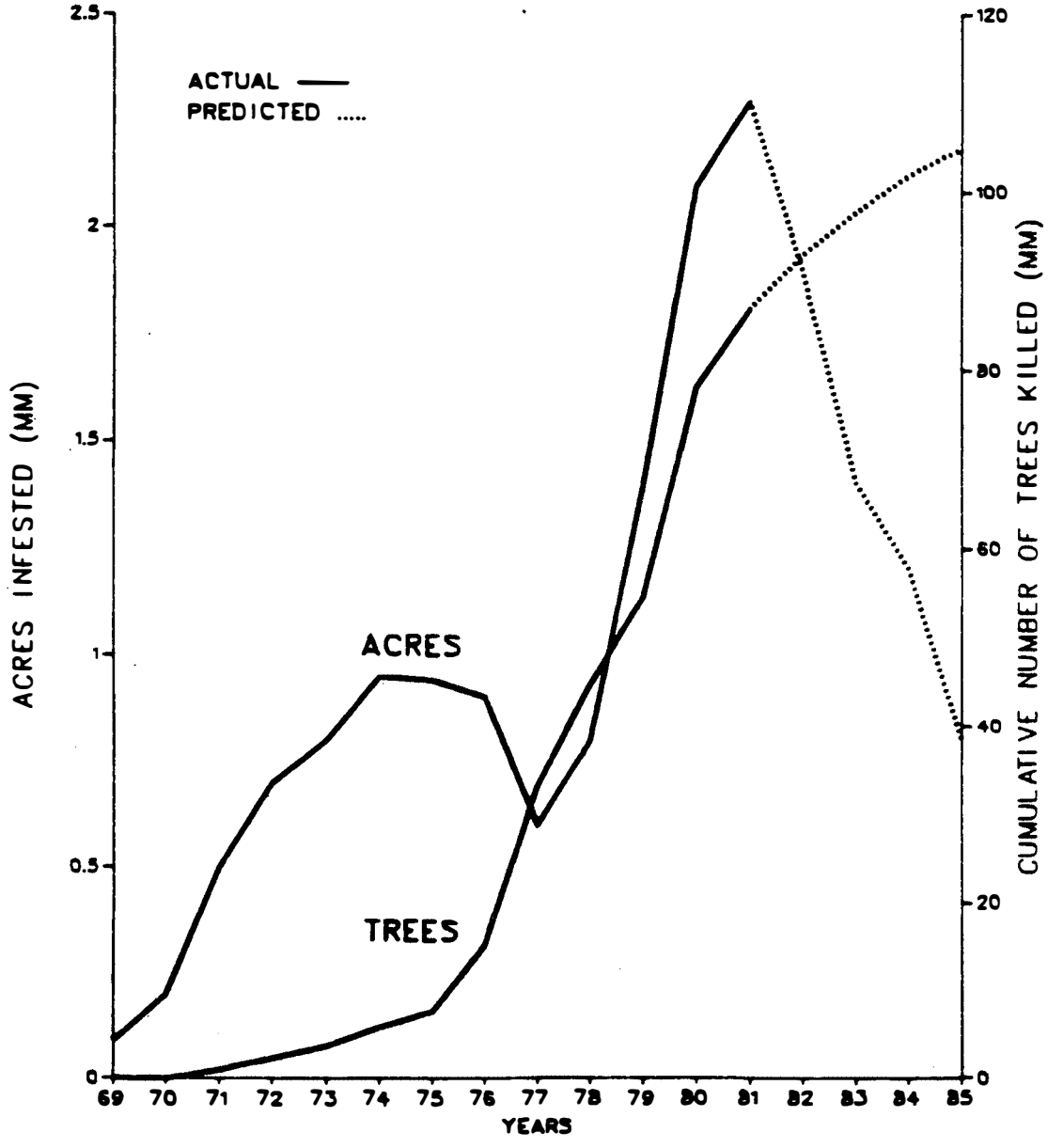
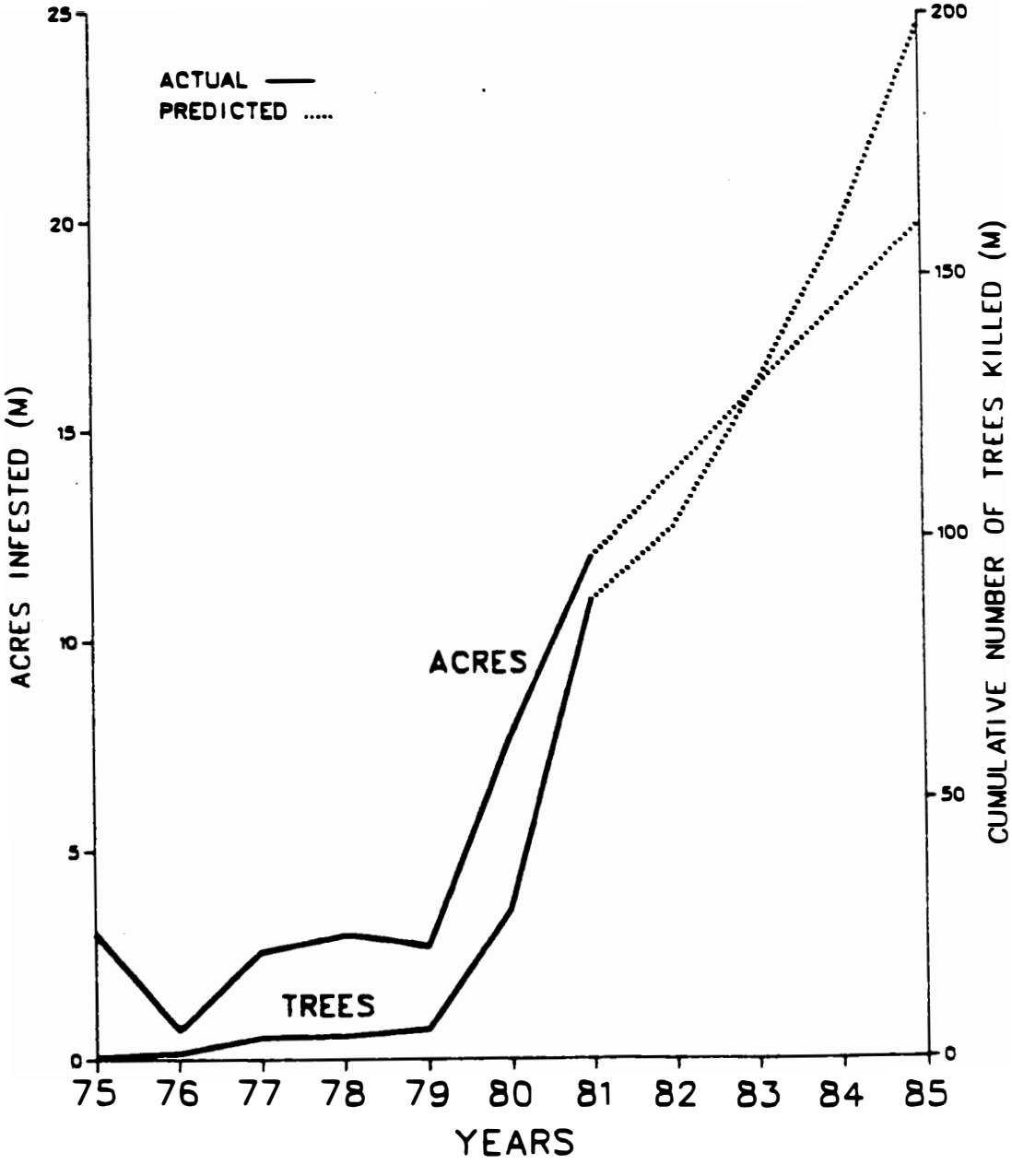


FIGURE 2A

LODGEPOLE PINE MORTALITY CAUSED BY MPB
IN NORTHERN IDAHO



These estimates are considered conservative because many areas containing thousands of dead trees have been logged since 1973.

CURRENT STATUS

In Montana, acres infested progressively increased through 1981 then began to decline. The chronological progression of infestations in lodgepole pine stands by Forests and in National Parks is shown in figures 3-9 (see Appendix).

For comparative purposes, infested acres mapped during aerial detection surveys are shown in tables 2-9.

BEAVERHEAD NATIONAL FOREST

Infestation began developing in high hazard lodgepole pine stands on Federal and private ownership in the Jack Creek drainage in 1973. Since that time, lodgepole pine and higher elevation whitebark pine stands have been decimated in the Jack Creek drainage; lodgepole pine and whitebark pine stands have sustained significant losses from Quake Lake on the south end of the Madison Range north to Fall Creek.

Since 1976, beetle populations have infested and spread throughout lodgepole pine type from Ennis, Montana south to Red Rock Mountain and west throughout major drainages of Centennial Mountains to Corral Creek. Infestations expanded in susceptible stands in the Tobacco Root Mountains north of Ennis, Montana. Faded groups range from 50 to 3,000 trees/group between Spring Creek and Windy Pass. The epidemic on the Madison Ranger District and adjoining Federal, State, and private ownership declined from 302,620 acres in 1981 to 139,673 acres in 1982. Trees killed/acre ranged from 0 to 14 (average 4.7/ac.). The widespread infestation shows signs of abating particularly in stands where susceptible host has been depleted. Tree mortality is predicted to continue, and possibly increase in 1983, in areas containing susceptible stands particularly west up the Madison River (table 10). Approximately 26.2 MMBF are programed for removal in 1983, 20 MMBF of which are infested and/or in susceptible type.

DEERLODGE NATIONAL FOREST

The outbreak remained static on about 520 acres of lodgepole pine type on the Jefferson Ranger District in 1982. The two largest infestation centers mapped were at Marsh Creek and Coyote Flat Spring. Smaller infested groups of 3 to 20 trees were observed at Sheep Mountain, Delmoe, Delmoe Park, and Whiskey Gulch. Five additional 5- to 30-tree groups were observed near Elmer Creek Campground, and scattered between Quinn and Farnham drainages near Boulder, Montana. A static to slightly increasing trend is predicted for 1983.

Table 2.--Acres infested by Ranger District, Beaverhead National Forest, and adjacent State and private lands, 1972-82.

		National Forest		State and private lands			
Ranger District	Year	Lodgepole pine	Whitebark pine	Lodgepole pine	Whitebark pine	Lodgepole pine total	Total
Madison	1972						
	1973	730					730
	1974	2,750					2,750
	1975	6,750		2,930			9,680
	1976	8,482					8,482
	1977	11,475	10	4,358	20	15,833	15,863
	1978	44,207	4,780	17,865	520	62,072	67,372
	1979	69,079	1,985	26,023	1,246	95,102	98,333
	1980	82,498	21,030	36,507	11,165	119,005	151,200
	1981	119,425	450	62,840	30	182,265	302,620
	1982	89,634	5,642	44,397		134,031	139,673
Wise River	1982	120					120
Sheridan	1981	140					140
	1982	80					80

Table 3.--Acres infested by Ranger District, Flathead National Forest, and adjoining State and private lands, 1975-82.

Year	Ranger District: Glacier View LPP	Glacier View WBP	Glacier View WWP	Hungry Horse LPP	Hungry Horse WBP	Hungry Horse WWP	Spotted Bear LPP	Spotted Bear WWP	Swan Lake LPP	Swan Lake WBP	Swan Lake WWP	Tally L. LPP	State & Private LPP	State & Private WBP	State & Private WWP	Total acres LPP	Total acres WBP	Total acres WWP	Grand total
1975	80	0	0	300	0	500		75	0	0	0	5	0	0	0	385	0	575	845
1976	1,213	192	5	5	0	150	30	20	0	0	0	0	2,474	195	0	3,692	387	155	4,234
1977	12,913	0	20	0	0	450	20	0	4	0	0	0	14,747	40	0	27,680	40	470	28,190
1978	48,494	0	25	0	0	350	25	0	0	150	0	0	30,442	0	0	78,936	150	375	79,461
1979	61,780	22,426	150	20	0	1,218	20	50	25	2	150	100	35,934	1,771	250	97,879	24,199	1,818	123,914
1980	85,160	93,525	420	21,567	0	600	3,070	50	0	310	3	12,840	96,015	3,050	0	218,652	96,885	1,073	316,610
1981	88,314	7,100	0	8,738	0	5,376	1,300	900	450	0	0	9,620	66,637	100	1,270	175,059	7,200	7,546	189,805
1982	32,408	17,694	30	1,475	800	150	50	30	1,420	0	850	6,370	44,127	900	2,123	85,850	19,390	3,183	108,423

Table 4.--Acres infested by Ranger District, Gallatin National Forest, 1969-82.

Year	Ranger District: Big Timber LPP*	Livingston LPP	Gardiner LPP	Bozeman LPP	Gallatin LPP	Hebgen LPP	State & private LPP	Total
1969					50			50
1970					720			720
1971					1,860			1,860
1972					3,050			3,050
1973					5,600			5,600
1974					6,400	4,480		10,880
1975					8,830	41,240	3,095	53,165
1976					52,179	59,244	21,523	132,946
1977				3,282	95,035	78,634	47,820	224,771
1978				16,216	97,312	79,061	52,110	244,689
1979	5	3,326	381	50,775	174,306	103,702	108,716	441,216
1980	80	26,235	5,420	63,408	124,795	103,152	221,089	544,179
1981	1,309	49,180	25,571	62,643	195,027	124,253	180,537	638,511
1982	120	39,739	33,149	55,340	198,647	105,443	140,000	572,438

*LPP = lodgepole pine

Table 5.--Acres infested by Ranger District, Kootenai National Forest, 1975-81.

		Host				
Ranger District	Year	Lodgepole pine	Whitebark pine	Western white pine	Ponderosa pine	Total
Cabinet	1975			2,000	10	2,010
	1976					0
	1977			1		1
	1978				25	25
	1979					0
	1980	250			100	350
	1981					0
	1982	210	20			230
Fisher River	1975	270		15	130	415
	1976	860				860
	1977	610			2	612
	1978	1,618			30	1,648
	1979	3,904			410	4,314
	1980	13,610			80	13,690
	1981	25,770			200	25,790
	1982	32,547			80	32,627
Fortine	1975				100	100
	1976					
	1977					
	1978	50				50
	1979	360			150	510
	1980	1,160				1,160
	1981	3,090	120			3,210
	1982	4,642	500	40		5,182
Libby	1975	370		30	60	460
	1976	275	10			285
	1977	450			1	451
	1978	589				589
	1979	1,720			25	1,745
	1980	970			140	1,110
	1981	800			100	900
Rexford	1975	100	120	30	30	950
	1976	401				401
	1977	576			2	578
	1978	1,167				1,167
	1979	1,868				1,868
	1980	3,350				3,350
	1981	4,800				4,800
	1982	7,482				7,482
State and private lands	1979	7,796			30	7,826
	1980	19,648			220	19,868
	1981	33,080		30	650	33,760
	1982	50,075				50,075
Yaak	1975	5,110			660	5,770
	1976	18,894				18,894
	1977	15,572			20	15,592
	1978	19,820				19,820
	1979	32,951				32,951
	1980	64,656				64,656
	1981	74,315				74,315
	1982	73,817				73,817

Table 6.--Acres infested by Ranger District, Lolo National Forest and adjacent State and private lands, 1975-82.

		National Forest				State and private lands				
Ranger District	Year	Lodgepole pine	Ponderosa pine	Western white pine	Whitebark pine	Lodgepole pine	Ponderosa pine	Western white pine	Whitebark pine	Total acres
Plains	1975	2,405	30			2,600	100			5,135
	1976					17,174	75			17,249
	1977	3,475				7,124	60			10,659
	1978	6,915				17,646	75			24,636
	1979	5,535	85			3,174				8,794
	1980	12,670	80			14,421	859			27,987
	1981	9,430				15,020	60			24,510
	1982	15,989				14,549				30,538
Thompson Falls	1980	650	20							670
	1981	600								600
	1982	1,380								1,380
Nine Mile	1980	30	60							90
	1981									
	1982	720								720
Superior	1980	410	50							460
	1981									
	1982			580						580
Missoula	1980		120							120
	1981		250							250
	1982									
Seeley Lake	1980	80								80
	1981									
	1982									

Table 7.--Acres and trees infested by year, Glacier and Yellowstone National Parks, 1970-82.

	Glacier NP		Yellowstone NP	
Year	Acres	Trees	Acres	Trees
1970			154,700	250,000
1971			497,000	700,000
1972	1,180	12,862	687,500	1,200,000
1973	3,600	39,240	825,000	1,300,000
1974	4,630	152,242	828,400	1,600,000
1975	13,354	257,732	692,228	692,288
1976	103,887	4,841,134	614,206	1,000,000
1977	142,871	10,958,205	129,300	2,844,160
1978	164,492	5,813,311	171,244	1,371,684
1979	215,000	3,148,742	431,114	3,815,359
1980	276,266	10,007,795	821,300	2,335,250
1981	189,350	1,831,860	964,878	2,555,498
1982	31,619	1,018,682	957,728	1,430,045

Table 8.--Acres infested by host type, Nezperce National Forest, 1979-1982.

	Ranger District				
	Red River	Elk City		Total	
Year	LPP*	LPP	PP*	LPP	PP
1979	50	250		300	
1980	550	1,000		1,550	
1981	900	2,000		2,900	
1982	1,000	1,300	400	2,300	400

*LPP = lodgepole pine
PP = ponderosa pine

Table 9.--Acres infested by host type on BIA lands, 1977-1982.

	Blackfeet	Crow	N. Cheyenne	Rocky Boy's	Ft. Belknap	Flathead		Total
Year	LPP*	PP*	PP	PP	PP	LPP	PP	
1977		3,389			2,660		100	6,049
1978		7,115		150	995		180	8,440
1979	200	1,940		150	592		150	3,032
1980	2,500	4,290		15	1,890	80	120	8,895
1981	5,168	4,090	1,319	100	1,620		200	12,497
1982	7,626	1,180	200	633	633	1,990	815	14,157

*LPP = lodgepole pine
PP = ponderosa pine

Table 10.--Tree and volume loss 1980-82 and predicted trend, Beaverhead National Forest.

Area	Trees killed/acre 1980	1981	1982	Total	Predicted mortality T/A	Vol. A (cu. ft.)	Years for mortality to occur	Predicted trend
Madison RD								
Bean Cr.	5.8	6.9	9.0	12.7	57.8	1076.3	9	Increasing
Bogus Cr.	49.8	16.1	9.2	75.1	257.3	2703.6	10	Static
Diamond J Ranch	7.2	12.4	2.6	22.2	36.9	821.3	5	Decreasing
Elk River	16.9	7.9	2.9	27.7	51.9	1433.2	5	Decreasing
Flatiron Mtn.	7.8	14.3	10.7	32.8	117.2	1449.2	7	Static
Gazelle Cr.	6.1	22.4	6.9	35.4	145.1	1781.1	9	Static
Jack Cr.	115.5	20.2	0	135.7	259.4	2799.1	5	Decreasing
W. Fk. Madison R.	26.2	4.8	2.0	33.0	72.5	1921.8	7	Static
N. Meadow Cr. #1	15.0	9.5	3.9	38.4	101.0	1955.2	10	Static
N. Meadow Cr. #2	8.4	13.7	14.9	37.0	114.1	2252.7	10	Increasing
Moss Cr.	16.4	4.1	0	20.5	42.4	1588.9	8	Decreasing
Partridge Cow Camp	12.3	1.1	7.4	20.8	62.9	1325.9	10	Increasing
Soap Cr. #1	17.8	38.8	3.9	60.5	216.3	2416.3	10	Static
Soap Cr. #2	21.1	86.4	6.4	113.9	195.6	2175.2	6	Decreasing
Average	23.3	18.5	5.1	50.9	123.6	1835.7	-	Static
Centennial Valley RD								
Humphrey Cr.	2.5	1.9	6.6	11.0	91.8	2340.7	10	Increasing
Lakeview	16.1	0	2.4	18.5	34.6	636.8	4	Increasing
Red Rock	8.3	6.3	0	14.6	42.1	867.0	10	Static
Average	9.0	2.7	3.0	14.7	56.2	1269.5	-	Increasing
Combined Average	20.8	15.7	4.7	89.9	111.7	1735.8	-	

FLATHEAD NATIONAL FOREST

The epidemic declined for the third straight year Forest-wide. Infested acres declined by more than half, with greatest reductions occurring on the Glacier View, Hungry Horse, Spotted Bear, and Tally Lake Ranger Districts. Infestation in lodgepole pine stands declined by one-third on adjacent State and private lands. A significant upswing occurred in whitebark pine stands where infested acres increased from 7,200 in 1981, to 19,390 in 1982. The majority of mortality occurred in high elevation stands throughout the Whitefish Mountain range between Columbia Falls and the Canadian border. Area with western white pine mortality declined by half from 7,546 acres in 1981 to 3,183 acres in 1982. Tree mortality was confined to old-growth stands around Hungry Horse Reservoir, Hungry Horse Ranger District, and in the Depuy and McGinnis drainages, Glacier View Ranger District, and in the Stillwater State Forest north of Whitefish, Montana.

Although infested acreage declined, the number of trees killed/acre increased except on the Glacier View Ranger District (tables 11 and 12).

Lodgepole pine mortality has been extensive in some stands around Bitterroot and Ashley Lakes, Griffin Creek, and Cottonwood Creek drainages. Tree mortality is just as severe in many of these stands as that which occurred in the North Fork Flathead River drainage.

Accelerated management of both pure and mixed high-hazard lodgepole pine stands has resulted in harvesting 218 MMBF from 17,200 acres since 1975. About 75 MMBF are planned for harvesting from 12,500 acres in 1983. This is an increase of one-third from that harvested in 1982. Salvage of infested and high-hazard green trees has significantly reduced infestation in susceptible stands. However, the potential for increase exists and tree mortality will intensify particularly in stands in and adjacent to the Tally Lake, Swan Lake, and portions of the Hungry Horse Ranger Districts in 1983 (table 12).

GALLATIN NATIONAL FOREST

Bozeman-Gallatin Ranger District

More than one-third of the susceptible lodgepole pine type on the Forest is infested. A significant decline in number of infested trees occurred on the Gallatin Ranger District where the outbreak began in 1969, and also on the Bozeman Ranger District where the epidemic has persisted since 1977 (table 13). Trees killed/acre declined from 28 in 1981, to one in 1982 on the Gallatin Ranger District, and from 9 to 7/acre on the Bozeman Ranger District. A continued increase and expansion is predicted in mature lodgepole pine stands in the Bridger Mountains and in the Bozeman Pass area.

Beetle populations have declined as a result of reduced brood production, poor survival, and competition from secondary bark beetles in small diameter immature trees where epidemic infestation has persisted for 10 years. Small isolated pockets of mortality will persist in stands containing mature-overmature trees, but an overall decline in area infested and trees killed is predicted in 1983.

Although infested acreage declined, the number of trees killed/acre increased except on the Glacier View Ranger District (tables 11 and 12).

Table 11.--Summary of infested trees/acre and predicted trend by District, Flathead National Forest, 1980-1982.

Ranger District	1980	1981	1982	Predicted trend
Tally Lake	14.5	31.8	63.6	Increasing
Swan Lake	4.6	21.7	44.9	Increasing
Hungry Horse	34.2	16.0	40.7	Increasing
Glacier View	52.0	0	0	Declining
Spotted Bear	0.7	1.2	0.5	Declining
	FOREST SUMMARY			
Total average	15.4	24.6	50.8	

Lodgepole pine mortality has been extensive in some stands around Bitterroot and Ashley Lakes, Griffin Creek, and Cottonwood Creek drainages. Tree mortality is just as severe in many of these stands as that which occurred in the North Fork Flathead River drainage.

Accelerated management of both pure and mixed high-hazard lodgepole pine stands has resulted in harvesting 218 MMBF from 17,200 acres since 1975. About 75 MMBF are planned for harvesting from 12,500 acres in 1983. This is an increase of one-third from that harvested in 1982. Salvage of infested and high-hazard green trees has significantly reduced infestation in susceptible stands. However, the potential for increase exists and tree mortality will intensify particularly in stands in and adjacent to the Tally Lake, Swan Lake, and portions of the Hungry Horse Ranger Districts in 1983 (table 12).

Table 12.--Tree and volume loss 1980-82 and predicted trend, Flathead National Forest.

Area	Trees killed/acre 1980	1981	1982	Total	Predicted mortality T/A	Vol. A (cu. ft.)	Years for mortality to occur	Predicted trend
Tally Lake RD								
Bitterroot L.-7	19.3	42.9	239.7	201.9	201.9	2101.3	4	Declining
Bitterroot L.-19	33.7	168.4	54.1	267.2	331.7	1998.8	4	Static-Declining
Bitterroot L.-35	3.7	46.4	160.0	210.1	225.5	1819.2	2	Declining
Brush Cr. Div.-12	2.9	10.4	18.6	32.3	148.1	3827.1	8	Increasing
Cottonwood Cr.-22	12.6	9	59.0	71.6	427.8	4712.7	10	Increasing
Fish Cr.-16	3.5	29.7	32.6	65.8	213.0	3151.5	5	Increasing
Griffin Cr.-17	0	0	14.0	14.0	188.0	3283.9	10	Increasing
Griffin Cr.-24	26.2	22.4	77.5	126.1	211.5	4456.7	6	Increasing
Logan Cr.-25	50.3	0	23.8	74.1	145.4	1542.2	5	Increasing
Road #538-14	11.1	34.4	42.7	88.2	298.5	3695.0	10	Increasing
Road #538-24	13.0	34.9	124.8	172.7	334.3	4474.6	8	Increasing
Sheppard Cr.-1	8.0	19.2	31.9	59.1	133.1	2779.0	9	Increasing
Star Cr.-6	4.4	3.8	37.7	45.9	155.7	3167.9	10	Increasing
Average	14.5	31.8	63.6	109.9	237.4	3154.6	-	
Swan Lake RD								
Moore Sprg.-24	1.8	28.8	126.3	156.9	189.1	3060.1	3	Declining
Road #2987-18	12.3	14.4	45.1	71.8	248.0	4524.3	10	Increasing
Rogers L.-30	0	47.3	16.6	63.9	141.3	1729.1	6	Increasing
Trail #347-30	0	22.4	16.3	38.7	109.6	1421.4	9	Increasing
Wild Bill Mtn.-17	0	10.5	13.4	23.9	306.6	5619.8	7	Increasing
Wild Bill Mtn.-20	13.3	6.6	52.2	72.1	258.6	5330.4	8	Increasing
Average	4.6	21.7	44.9	71.2	208.9	3614.2	-	
Hungry Horse RD								
Abbott Bay	23.9	0	57.1	81.0	209.5	3651.6	10	Increasing
Emery Bay C.G.	32.8	9.8	0	42.6	162.3	2385.4	10	Increasing
Lion Hill	45.8	38.2	65.0	149.0	253.4	3675.4	5	Declining
Average	34.2	16.0	40.7	90.9	208.4	3237.5		Increasing
Glacier View RD								
Big Cr.-27	52.0	0	0	52.0	79.0	559.5	5	Declining
Average	52.0	0	0	52.0	79.0	559.5	-	
District Summary								
Tally Lake	14.5	31.8	63.6					Increasing
Swan Lake	4.6	21.7	44.9					Increasing
Hungry Horse	34.2	16.0	40.7					Increasing
Glacier View 1/	52.0	0	0					Endemic
Forest Summary	15.4	24.6	50.8					Increasing

1/ One plot.

Gardiner Ranger District

An increase in tree mortality and an expansion in infested acres occurred for the fifth consecutive year (table 13). The largest expansion in acres and groups of faders occurred from the Yellowstone National Park boundary north to Red Mountain and from Tom Miner Creek south to Yellowstone National Park. More than 500,000 trees were killed in 1982, bringing the total to 1.3 million trees killed since 1978. Evaluations indicate tree mortality will increase in 1983 (table 13). The potential for the infestation to spread is high due to the expanding epidemic in adjacent stands in the northern portion of Yellowstone National Park.

Livingston Ranger District

A reduction in tree mortality and acres infested occurred on the Livingston Ranger District (table 13). Infestation declined east of the Yellowstone River between Mill and Dry Creek drainages, and from Interstate 90 south to Big Creek on the west side of the District. A continued decline is predicted for older epicenters in 1983, but additional tree mortality is predicted in stands infested for less than 5 years.

Newly developing outbreaks were detected in the Crazy Mountains. Infestations will multiply in susceptible lodgepole pine stands in Cottonwood and Little Cottonwood, Ibex, Rock Creek, Spring Creek, and other drainages along the west side of the Crazy Mountains in 1983.

Big Timber Ranger District

Aerial and ground surveys indicate a declining outbreak on the Big Timber Ranger District. However, evaluations were limited and tree mortality may occur in localized areas in 1983.

The widespread tree mortality the past 12 years has resulted in increased harvesting of infested and green stands throughout the Forest. Since 1977, 147.4 MMBF have been removed from 17,200 acres. About 24 MMBF (90 percent lodgepole pine) are planned for harvesting from 2,400 acres in 1983.

Hebgen Lake Ranger District

Although infestation was mapped on 105,443 acres during aerial surveys in 1982, most of the trees killed were small diameter lodgepole pine that were killed by secondary bark beetles. Prisim plots from infested stands showed a decline in all areas except Beaver Creek where sufficient susceptible host exists to maintain the outbreak for 2 to 3 additional years (table 13).

LEWIS AND CLARK NATIONAL FOREST

Infestation in second-growth ponderosa pine stands has increased steadily since 1980. More than 43,000 acres were infested in 1980, 53,800 in 1981, and 104,193 in 1982 on mixed ownership. Infestation was insignificant

Table 13.--Tree and volume loss 1980-82 and predicted trend, Gallatin National Forest.

Area	Trees killed/acre 1980	1981	1982	Total	Predicted mortality T/A	Vol. A (cu. ft.)	Years for mortality to occur	Predicted trend
Big Timber RD								
N. Derby Gulch	37.1	9.8	0	46.9	87.1	1218.8	5	Static
Bozeman RD								
Bozeman Cr.	38.2	8.8	41.6	88.6	200.2	3572.4	8	Increasing
Cresent Lk.	23.3	19.3	1.8	44.4	123.2	3862.4	5	Static-Declining
Fairy Lk.	6.9	1.7	0	8.6	223.5	2889.6	10	Increasing
Flathead Pass	8.6	0	0	8.6	202.0	3019.3	10	Static
Hood Cr.	23.1	11.6	11.1	45.8	156.9	4816.5	7	Static-Increasing
Jackson Cr.	27.4	10.1	0	37.5	147.9	4092.5	7	Static-Declining
Moser Cr.	69.0	7.8	4.2	81.0	179.1	3214.9	6	Static
Mystic Lk.-30	16.3	0	7.6	23.9	133.7	4050.4	7	Increasing
Mystic Lk.-36	0	17.9	6.3	24.2	290.7	4876.4	10	Declining
Thurman Gulch	2.2	11.9	0.8	14.9	126.0	1118.6	10	Increasing
Average	21.5	8.9	7.3	37.7	178.3	3551.3	-	
Gallatin RD								
Big Sky	65.7	153.0	0	218.7	443.1	3236.6	10	Declining
Buck Cr.-1A	4.5	13.5	8.1	26.1	94.9	2768.8	10	Static
Buck Cr.-2A	5.7	1.3	0	7.0	94.3	2026.4	10	Declining
Buck Cr.-S	10.1	0	0	10.1	53.0	1148.6	7	Declining
Buck Cr.-W	10.6	0	0	10.6	163.2	3961.6	9	Declining
Cinnamon Cr.	38.5	14.8	0	53.3	125.3	2966.4	10	Declining
Cinnamon R.S.	2.6	30.8	0	33.4	83.4	1928.7	6	Declining
Spanish Cr.	59.7	9.8	0	69.5	206.3	1933.8	10	Declining
Average	24.7	27.9	1.0	53.6	157.9	2496.4	-	Declining
Gardiner RD								
Bear Cr. E.	2.9	1.2	0.7	4.8	95.9	2482.2	6	Static
Bear Cr. W.	13.7	5.1	1.8	20.6	47.5	1421.6	8	Declining
N. Fk. Bear Cr.	12.5	11.8	6.9	31.2	84.2	2943.2	10	Declining
Crevice Cr.	3.3	13.5	15.7	32.5	136.9	2804.1	8	Increasing
Eagle Cr.	10.1	7.2	30.6	37.9	67.6	2077.3	3	Increasing
Average	8.5	7.8	9.1	25.4	86.5	2345.7	-	Static-Increasing
Hebgen Lk. RD								
Beaver Cr.	55.7	7.8	13.8	77.3	199.2	3446.8	10	Increasing
Beaver Cr. Camp	19.7	11.7	9.6	41.0	107.6	2161.0	6	Static-Increasing
Rumbaugh Cr.	8.9	1.0	1.4	11.3	48.6	1955.4	7	Static
Average	28.1	6.8	8.3	43.2	118.5	2521.1	-	Static
Livingston RD								
Balm of Gilead Cr.	3.5	9.9	54.8	68.2	231.1	2965.0	6	Increasing
Dry Cr.	44.8	58.5	3.7	107.0	237.7	2770.5	5	Declining
Ibex Sec. 14	7.0	2.8	8.3	18.1	91.9	1799.3	6	Increasing
Ibex Sec. 24	0	3.6	0	3.6	137.0	2203.7	10	Increasing
Pine Cr.	6.2	0	9.1	15.3	430.5	3913.5	10	Increasing
Pole Gulch	50.2	19.3	4.7	74.2	203.1	3704.0	7	Declining
Rock Cr.	37.4	25.1	0	62.5	86.4	3057.3	2	Declining
Suce Cr.	11.4	0	4.7	16.1	274.5	5605.8	10	Increasing
Wineglass Mtn.	102.5	27.6	0	130.1	191.1	1814.4	4	Declining
Average	29.2	16.3	9.5	55.0	209.3	3092.6	-	Static-Increasing

in lodgpeole and whitebark pine stands. Small infestations were detected in the north and south Moccasin Mountain ranges. Group kills ranged from 6 to 40 trees/group. Upwards of 20 to 100 trees/group were killed between Limekiln Canyon and Porphyry Peak near Maiden Mountain, Stanford Ranger District. Additional tree mortality was detected on BLM lands in Little Careless, Niel, Dry, Buffalo, Ashley, Canyon, and West Fork Willow Creeks. Widely scattered tree mortality was mapped throughout the Little Snowies and Flatwillow drainages. Infestation is predicted to remain static or increase slightly in 1983.

LOLO NATIONAL FOREST

Infestation increased from 18,195 acres in 1981 to 32,638 acres in 1982 in lodgepole and ponderosa pine stands, mostly on the Plains Ranger District. Outbreaks increased significantly, with up to 10,000 trees/group in the N. Fork Murr, Paris, Crescent Lake, Shroder, Chippy, Lazier, Border Peak, Radio, Meadow, Cool, and Bear Trap drainages. Hundreds of smaller faded groups ranging from 20 to 300 trees/group were observed throughout the Thompson River drainage from Middle Thompson Lake south to Highway U.S. 200.

Infested acres increased from 600 in 1981 to 1,350 acres in 1982 in lodgepole pine stands on the Thompson Falls Ranger District. More than 48,000 trees were killed during 1982. The majority of infestation developed and spread in Daisy, Fishtrap, W. Fork Fishtrap, and Whiteface Creek drainages.

New outbreaks developed on 720 acres in Beecher, Burnt Fork, Nugget, and Sawpit drainages, Ninemile Ranger District, where about 8,200 lodgepole and ponderosa pines were attacked in 1982.

Predictions for 1983 are provided in table 14.

Since 1977, 25.5 MMBF have been removed from 4,900 acres of high-hazard lodgepole pine stands. Approximately 25 MMBF are planned for sale in 1983 which includes salvage cutting infested stands, management of green high-hazard stands, and thinning for post and pole sales in low- and moderate-risk stands within the same acreage.

Infestation increased from 3,885 acres in 1981 to 4,700 acres in 1982 in ponderosa pine stands in the Garnet Mountain Range east of Missoula, Montana. Tree mortality was confined to groups ranging from 1 to 75 trees/group between Sunset Hill and Diamond Mountain on the south side of the Blackfoot River and in the Black Canyon area. Extensive logging and thinning of second-growth ponderosa pine stands has significantly reduced infestation on State and private lands during the past 10 years.

KOOTENAI NATIONAL FOREST

The widespread infestations on the Kootenai National Forest increased by 27,500 acres from 1981 to 1982. About 827,000 trees were killed on 170,363 acres in 1982. Stand surveys show tree mortality increased 2½ times from 1980 to 1981, and nearly doubled from 1981 to 1982.

Table 14.--Tree and volume loss 1980-82 and predicted trend, Lolo National Forest.

Area	Trees killed/acre 1980	1981	1982	Total	Predicted mortality T/A	Vol. A (cu. ft.)	Years for mortality to occur	Predicted trend
Ninemile RD								
Beecher Cr.	4.6	1.1	24.5	30.2	80.4	2024.9	6	Increasing
Burnt Fk. Cr.	2.2	14.8	7.1	24.1	51.7	1808.3	3	Increasing
Nuggett Cr.	0	30.6	8.9	39.5	72.7	959.1	7	Static-Declining
Saw Pit Cr.	5.5	17.3	5.3	28.1	62.9	1717.8	7	Static-Declining
Average	3.1	15.9	11.5	30.5	66.9	1627.5	-	
Plains RD								
Beartrap Cr.	76.2	30.6	75.3	182.1	377.9	5760.1	10	Increasing
Buffalo Bill Cr.	0	0	51.9	51.9	139.4	1454.0	8	Increasing
Chippy Cr.	53.6	0	8.3	61.9	218.3	2181.1	10	Increasing
Fishtrap Lk.	19.5	8.9	33.0	61.4	34.4	2878.2	8	Increasing
N Fk Murr Cr. 20	13.6	80.2	106.6	200.4	278.7	4825.0	7	Increasing
N Fk Murr Cr. 35	2.1	28.8	46.0	76.9	267.6	4240.0	7	Increasing
Richards Pk. Rd.	34.1	50.2	47.1	131.4	265.2	2267.9	9	Increasing
#93 Jct.	27.3	29.9	44.4	101.6	457.1	4147.5	10	Increasing
Rock Cr.	29.0	41.1	72.1	142.2	320.4	3956.0	10	Increasing
Average	28.4	30.0	53.8	112.2	284.3	3523.3	-	Increasing
Thompson Falls RD								
Daisy Cr.	27.6	17.7	56.8	102.1	149.2	2170.2	4	Increasing
Fishtrap Cr.	33.7	61.5	41.2	136.4	646.8	4076.7	6	Increasing
W Fk Fishtrap Cr.	14.7	14.4	44.3	73.5	313.0	4517.4	4	Increasing
Whiteface Cr.	9.2	15.2	34.8	59.2	342.7	3462.9	10	Increasing
Average	21.3	27.2	41.6	92.8	362.9	3556.8	-	Increasing
District Summary								
Ninemile	3.1	15.9	11.5					Static
Plains	28.4	30.0	53.8					Increasing
Thompson Falls	21.3	27.2	44.3					Increasing
Forest Summary	20.8	26.0	41.6					Increasing

Fisher River Ranger District

An average of 143 trees have been killed/acre (range 24 to 312/ac) on the Fisher River Ranger District (table 15). The most widespread and severe infestations occurred on mixed ownership around McGregor Lake. Tree mortality in this area duplicates the extensive tree mortality observed in the North Fork Flathead River drainage from 1975 through 1980. Epicenters expanded in size with increased tree mortality in the Fisher River drainage south and west of Middle Thompson and Loon Lakes. Upwards of 4,000 trees were killed in large expanding infestations between Fritz Mountain and Enterprise Hill. Expanding centers, upwards of 2,500 trees/group, were detected in Redemption Creek, Dunn Creek, and Brush Creek, all tributaries of Wolf Creek drainage. Infestations of 10 to 5,000 trees were observed throughout Pleasant Valley.

Fortine Ranger District

More than 215,000 trees were killed on 4,600 acres on the Fortine Ranger District in 1982. Trees killed/acre averaged 46 in 1982 compared to 2.9/acre in 1981. Largest outbreaks occurred in Paul, Louis, Fortine, and Sunday Creek drainages. Smaller infestations of 2- to 50-tree groups are scattered throughout the District. White pine mortality was detected in small 3- to 25-tree groups in Graves, Clearance, and Water Creek drainages.

Rexford Ranger District

An estimated 174,000 trees were killed on 7,482 acres of the Rexford Ranger District. The largest expansion occurred in the Gold-Cliff Creek drainages with new infestations developing in Holdup Gulch and Good Creek. Small groups of faders are scattered throughout the District and are predicted to expand in 1983 (table 15).

Yaak Ranger District

The largest and most serious outbreak continued to cause widespread mortality in the Yaak River drainage. More than 220,000 trees were killed on 73,800 acres in 1982. Extensive tree mortality has occurred between Whitetail Creek and Fast Creek in the upper Yaak River drainage. Smaller group kills were detected and are predicted to expand in Burnt, Spread, N. Fork Meadow, Seventeen Mile, and in southern portions of the Yaak River drainage.

Tree mortality will decline in older epicenters in the upper Yaak drainage and in Gold Creek, but many existing infestations are predicted to expand and new ones will develop and spread in susceptible stands in 1983 (table 15).

Libby Ranger District

Infestation declined on the Libby Ranger District. Largest group kills were observed in 4th of July Creek and Hoodoo Creek with small group kills scattered throughout the Fisher River drainage. Infestations are predicted to remain static or decline slightly in 1983 (table 15).

Table 15.--Tree and volume loss 1980-82 and predicted trend, Kootenai National Forest.

Area	Trees killed/acre 1980	1981	1982	Total	Predicted mortality T/A	Vol. A (cu. ft.)	Years for mortality to occur	Predicted trend
Fisher River RD								
Alder Cr.	0	10.2	19.4	29.6	31.6	550.4	1	Increasing
Bay Horse Cr.	0	24.5	0	24.5	253.5	2223.6	10	Increasing
Brush Cr.	12.1	22.0	146.2	180.3	226.5	4278.4	7	Declining
Cody Cr.	13.7	22.4	34.6	70.7	105.3	925.2	5	Increasing
Deer Cr.	0	27.5	79.4	106.9	242.3	4482.1	10	Increasing
Fawn Cr.	33.4	127.8	151.1	312.3	353.6	2692.5	4	Declining
Lost Prairie-753	31.4	0	96.2	127.6	165.5	1370.5	4	Increasing
Lost Prairie-7514	31.2	5.4	118.0	154.6	181.5	5130.0	3	Declining
Lost Prairie-ST1	16.8	24.4	67.8	109.0	183.2	2526.8	6	Increasing
McGregor L.	0	194.2	56.1	250.3	434.3	1949.2	5	Declining
McGregor L sec 18	33.1	67.2	39.1	139.4	163.5	3496.6	3	Declining
McGregor L sec 20	13.6	80.2	106.6	200.4	274.0	4799.4	7	Declining
McKellop Cr.	95.4	183.5	16.8	295.7	549.1	3077.0	4	Declining
Redemption Hill	3.2	0	36.6	39.5	154.1	2411.1	7	Increasing
Syrup Cr.	5.4	12.5	55.5	73.4	127.3	2107.5	6	Increasing
Tamarack Cr.	6.7	10.4	100.0	117.1	145.6	2760.9	3	Declining
Twin Cr.	0	0	203.6	203.6	468.4	3010.4	6	Increasing
Average	17.4	47.8	78.0	143.2	238.4	2811.3	-	
Fortine RD								
Beaver Cr.	0	1.9	57.2	59.1	201.9	3611.9	7	Increasing
Paul Cr.	7.1	4.0	35.3	46.4	251.3	3987.0	6	Increasing
Average	3.5	2.9	46.3	52.7	226.6	3799.4	-	Increasing
Libby RD								
Fisher Cr.	10.9	18.8	19.1	48.8	80.4	1749.8	4	Increasing
Hoodoo Cr.	4.5	14.0	0	18.5	30.2	880.8	8	Declining
Average	7.7	16.4	9.5	33.6	55.3	1315.3	-	Increasing
Rexford RD								
Big Cr.	26.4	0	0	26.4	85.8	1026.0	9	Increasing
Cliff Pt. Trl.	242.1	12.4	5.1	259.6	294.7	3771.8	2	Declining
Pinkham Cr.	109.5	38.0	0	147.5	203.2	2833.0	3	Declining
Upper Gold Cr.	13.2	32.3	87.8	133.2	374.2	6409.4	6	Increasing
Average	97.8	20.7	23.2	141.7	239.5	3510.0	-	Increasing
Yaak RD								
Basin Cr.	126.1	45.5	5.8	177.3	249.2	4438.0	4	Declining
E. Fk. Basin Cr.	23.2	7.4	31.0	61.6	210.6	6714.3	7	Increasing
Bunkerhill Cr.	14.5	50.4	19.3	84.2	147.1	2703.0	6	Declining
Caribou Cr.	37.1	34.4	46.3	117.8	189.7	4852.7	4	Increasing
Cool Cr.	59.3	41.6	13.4	114.3	195.6	4829.2	6	Declining
Grubstake Mtn.	11.2	28.4	49.0	88.6	227.1	2245.4	9	Increasing
Hensley Hill	23.1	66.0	65.4	154.5	195.1	1395.2	5	Declining
Lang Cr.	42.7	6.1	44.5	93.3	152.9	4317.0	3	Increasing
Lap Cr.	58.3	10.1	0	68.4	72.6	1966.3	2	Declining
Road #2355	22.3	0	22.4	44.7	167.0	3728.7	10	Increasing
Slim Cr.	61.2	10.4	0	716	133.8	3470.0	4	Declining
Vinal Cr.	25.0	42.0	52.4	119.4	221.4	2951.4	4	Increasing
Waper Ridge-E	124.1	9.8	0	133.9	147.7	3832.4	2	Declining
Waper Ridge-W	24.1	16.0	0	40.1	128.3	3118.5	5	Declining
Windy Fork	24.9	18.9	17.8	61.6	146.5	3335.5	5	Increasing
E. Fk. Yaak R-23	2.8	27.9	33.5	64.2	230.6	2950.3	10	Increasing
E. Fk. Yaak R-35	35.6	6.4	110.0	152.0	268.7	4444.2	7	Increasing
Average	42.1	24.8	30.1	96.9	181.4	3605.4	-	Increasing
District Summary								
Fisher River	12.4	47.8	78.0					Increasing
Fortine	3.5	2.9	46.3					Increasing
Libby	7.7	16.4	9.5					Static
Rexford	97.8	20.7	23.2					Increasing
Yaak	42.1	24.8	30.1					Increasing
Forest Summary	33.9	32.3	48.6					Increasing

The widespread mortality has resulted in increased harvesting since 1977. More than 147 MMBF were logged from 43,000 acres the past 6 years. In 1982, 71 MMBF were sold from high-hazard green stands and 21 MMBF were salvaged from heavily infested stands. About 50 MMBF were removed from 5,000 acres in 1982. In 1983, 90-100 MMBF of lodgepole pine, of which 30 percent are dead, are programed for sale on 10,000 to 12,000 acres.

GLACIER NATIONAL PARK

Infestation declined dramatically since 1980. On the west side of the Park, groups of faders (10 to 500/group) were widely scattered in McGee Meadows, Rogers Meadows, Quartz-Cummings, Bowman, Camas, Spruce, and Ford Creek drainages, and additional groups of faders occurred around Kintla, Bowman, Quartz, Logging, and Trout Lakes. Where stand structure has been reduced to mainly small trees, beetle populations and resultant tree mortality have declined from reduced brood production and poor survival in the small diameter trees. These small "hot spots" will continue to decline or die out in 1983. Larger mortality centers were observed from McDonald Lake southeast to Fielding Guard Station in the Middle Fork Flathead River drainage. Scattered group kills were mapped in Park, Coal, Pinchot, Nyak, Harrison, and Lincoln Gulch tributaries of the Middle Fork drainage.

Infestation has increased in lodgepole pine stands on the east side of the Park and on the adjoining Blackfeet Indian Reservation the past 5 years (table 16). Group kills of 50 to 100 trees were observed at Railroad Creek near East Glacier and along the south side of Two Medicine Lake. About 3,000 faders were mapped around St. Mary Lake and in Reynolds Creek drainage. Fifteen thousand faders occurred in groups of 10 to 1,000 trees/group along the west side of Lower St. Mary Lake and around Swift Current and Lake Sherburn, and several thousand trees were killed in Kennedy Creek drainage. The largest expansion in infested acres and tree mortality occurred in Lee Creek, Macowanis, and in the Belly River drainage where hundreds of thousands of trees were killed the past 2 years. Tree mortality increased significantly in the Middle and East Fork of Lee Creek, Otatso Creek, and Roberts Creek.

Surveys show 17 infested trees/acre (range 5 to 54/acre) in the southern two-thirds of the Park. Prism plots on the Blackfeet Indian Reservation show 2.3 trees/acre were killed in 1980, 4.4/acre in 1981, and 12.4/acre in 1982. More than 94,500 trees were killed in high-risk stands throughout the Reservation.

An increase in acres infested and tree mortality is predicted along the east side of the Park and on the Blackfeet Indian Reservation in 1983 (table 16).

Temperature-moisture conditions conducive to extensive winterburn during the winter of 1981-82 resulted in mortality to Douglas-fir from Douglas-fir beetle and flatheaded and roundheaded wood borers, and to subalpine fir from the western balsam bark beetle and several secondary bark

Table 16.--Tree and volume loss 1980-82 and predicted trend, east side, Glacier National Park.

Area	Trees killed/acre 1980	1981	1982	Total	Predicted mortality T/A	Vol. A (cu. ft.)	Years for mortality to occur	Predicted trend
Apikuni Flats	12.9	22.6	17.4	52.9	255.8	2286.5	6	Increasing
Dead Horse Pt.	2.5	29.7	4.6	36.8	43.0	428.5	2	Decreasing
Jule Cr.	13.8	18.8	17.1	49.7	172.7	1613.6	8	Static
Lee Cr.	4.8	7.6	7.7	20.1	183.7	1588.9	9	Static
Lee Ridge	9.1	29.8	8.6	47.5	322.9	1484.5	10	Static
Lost Lake	23.0	19.2	31.6	73.8	154.1	1744.5	5	Increasing
Nimrod	7.6	2.0	5.6	15.2	117.4	2873.9	10	Increasing
Wild Goose	31.1	39.2	54.5	124.8	172.4	2589.0	3	Increasing
Windy	27.1	20.3	12.8	60.2	232.6	2419.5	7	Static
Average	14.7	21.0	17.7	53.4	183.8	1892.1	-	Static

beetles. Pine engraver and secondary beetles may develop and cause some mortality in lodgepole pine. However, this associated mortality has not persisted for more than 1-2 years in the past.

YELLOWSTONE NATIONAL PARK

The infestation which began in 1967 in Yellowstone National Park continued at an epidemic level with about 957,000 acres infested in 1982. The western half of the Park is infested, with extensive tree mortality occurring from Harebell Patrol cabin at the south end of the Park, north to Little Cottonwood Creek. The outbreak expanded into the Lamar River drainage, and small epicenters were mapped at Tower and along the Yellowstone River between Canyon and Yellowstone Lake. More than 21 million trees have been killed since the epidemic began. Infestation is predicted to decline due to host depletion in older infestation centers in the western portion of the Park, but an increase is predicted in the eastern and northern timbered areas.

BUREAU OF INDIAN AFFAIRS

Infestation has been active in ponderosa pine stands on the Crow, Fort Belknap, Rocky Boy's, and Northern Cheyenne Reservations since 1977. Tree mortality increased in lodgepole pine stands on the Flathead Reservation since 1979.

Crow Reservation

Infestation declined in second-growth ponderosa pine stands from 4,090 acres in 1981 to 1,180 acres in 1982. Mortality increased from 17.5 trees/acre in 1981 to 26.7/acre in 1982. Infestations were mapped in South Fork Indian Creek, Cache, Corral, Little Corral, Thompson, and Little Thompson drainages. New outbreaks developed in Owl and Bear Creek drainages. Salvage logging removed 5.6 MMBF from 1,200 acres from 1978 to 1982. Sales are planned to remove 2.5 MMBF from 350 acres in 1983. Tree mortality is predicted to continue at the same level or increase slightly in 1983 (table 17).

Fort Belknap Reservation

Infestation declined in second-growth ponderosa pine stands in Beaver Creek drainage and in the upper tributaries of Bear Gulch from 1,620 acres in 1981 to 633 acres in 1982. Upwards of 500 faders were mapped in the largest epicenter in 1982. About 7.0 MMBF were logged from 3,390 acres from 1978 to 1982 in an effort to place stands under management and reduce infestation potential. Sales are planned to remove 100 MBF from 20 acres in 1983. Infestation is predicted to remain static or decline in 1983 (table 17).

Rocky Boy's Reservation

New ponderosa pine faders were mapped on 633 acres in 1982 compared to 100 acres in 1981. Surveys in Muddy and Sandy Creek drainages revealed no newly attacked trees where infestation has persisted since 1979.

Table 17.--Tree and volume loss during 1980-82 and predicted trend, Indian Reservations.

Area	Trees killed/acre 1980	1981	1982	Total	Predicted mortality T/A	Vol. A (cu. ft.)	Years for mortality to occur	Predicted trend
Crow IR								
Corral Cr. - 1	24.1	11.5	59.8	95.4	-	-	-	
Corral Cr. - 2	10.4	10.7	6.8	27.9	-	-	-	
Corral Cr. - 3	5.9	31.4	40.4	77.7	-	-	-	
Corral Cr. - 4	1.3	1.1	9.4	11.8	-	-	-	
Little Corral Cr.	40.0	14.3	31.9	86.2	-	-	-	
Lower Indian Cr.	50.2	49.7	31.6	131.5	-	-	-	
Wolf Mtn.	7.3	3.8	6.8	17.9	-	-	-	
Average	19.9	17.5	26.7	64.1	-	-	-	Increasing
Flathead IR								
Bassoo Cr.	4.4	0	22.4	26.8	214.5	2430.9	8	
Mill Cr.	6.0	5.6	34.6	46.2	206.2	2742.3	7	
Average	5.2	2.8	28.5	36.5	210.3	2586.6		Increasing
N. Cheyenne IR								
45 39E 34	0	0	0	0	0	0	0	
55 39E 3	9.5	0.7		47.9	58.1	0	0	
55 39E 11	0	16.5	20.2	36.7	0	0	0	
Average (2 plots)	4.7	8.6	34.1	47.4	0	0	0	Increasing
Average (3 plots)	3.2	5.7	22.7	31.6	0	0	0	
Rocky Boy's IR								
Muddy Cr.	6.5	6.1	0	12.6	0	0	0	
Sandy Cr.	1.4	1.4	0	2.8	0	0	0	
Average	3.9	3.8	0	7.7	0	0	0	Declining

Commercial thinning removed 547 MBF between 1978 and 1982. Commercial thinning is planned for overstocked stands on 400 acres from which about 1.0 MMBF will be logged in 1983. A continued decline in outbreak areas is predicted for 1983 (table 17).

Flathead Reservation

Tree mortality increased markedly in lodgepole pine and ponderosa pine stands in 1982. More than 500 lodgepole pine faders were observed in Clear Creek, with many smaller groups of 20 to 50 trees per group observed in Alder and Mill Creek drainages. Stand evaluations showed 22 newly attacked trees/acre in Bassoo drainage and 35/acre in Mill drainage. Mortality in ponderosa pine stands was widely scattered from Hot Springs north to Bassoo Creek, and from Hog Peak south to Irving Creek. Group kills ranged from 3 to 200 trees/group in 1982. Infested area will increase and tree mortality will intensify in 1983 (table 17).

Northern Cheyenne Reservation

Infestation was detected in second-growth ponderosa pine stands on 200 acres in 1982. Scattered groups of faders ranging from 2 to 40 faders/group were mapped in Skunk, Trail, Thompson, and Dry Creek drainages south and east of Busby, Montana. Tree mortality is predicted to increase in 1983 (table 17). Active sales have removed 28.3 MMBF from 8,500 acres between 1982 and 1983. Projections for 1983 are to commercially thin 1,500 acres, removing 5.0 MMBF as preventive management.

NEZPERCE NATIONAL FOREST

This outbreak has increased steadily since 1979. Although a decline in infested acreage as mapped from aerial survey is shown, infestation was noted in other portions of the Forest where lack of funds prevented detection surveys from being conducted.

Tree mortality increased in Deadwood, Blanco, Hays, and in several areas of Red River drainage. Trees killed/acre increased from 4.4 in 1981 to 9.9 in 1982 on the Elk City Ranger District and from 8.6 in 1981 to 11.2 in 1982 on the Red River Ranger District (table 18). Tree mortality averaged 10.7/acre for stands examined.

An increase in area infested and number of trees killed is predicted in 1983 (table 18). Stand exams have been completed and additional ones are planned to delineate high-hazard lodgepole pine stands and model predicted loss. A total 16.7 MMBF of lodgepole pine will be logged from 1,400 acres, and an additional 18 MMBF will be advertised for sale from 1,500 acres of high-risk stands to minimize potential loss in 1983.

CRAIG MOUNTAINS - BUREAU OF LAND MANAGEMENT

The epidemic continued to expand in lodgepole pine type from 4,980 acres in 1980, to 7,680 acres in 1981, to 25,564 acres in 1982. Mapped outbreaks occurred in Dog, Soldier, and Webb drainages. More than 1.8 million trees have been killed since 1975. In stands where evaluations were conducted, tree mortality ranges from 11 to 137/acre (table 19). Nearly 200,000 trees were killed in 1981, increasing to 500,000 in 1982. The infestation is predicted to increase and intensify in 1983.

Table 18.--Tree and volume loss 1980-1982 and predicted trend, Nezperce National Forest.

Area	Trees killed/acre 1980	1981	1982	Total	Predicted mortality T/A	Vol. A (cu. ft.)	Years for mortality to occur	Predicted trend
Elk City RD								
Deadwood Cr.	21.1	9.7	29.6	60.4	243.2	2836.2	6	Increasing
French Gulch	15.4	0	0	15.4	77.6	2158.5	10	Static
Lucky Strike	4.3	3.4	0	7.7	32.6	860.7	10	Static
Average	13.6	4.4	9.9	27.8	117.8	1951.8	-	Static-Increasing
Red River RD								
Blanco Cr.	19.7	2.8	21.3	43.8	133.5	2556.3	7	Increasing
Hays Cr.	19.2	7.3	8.0	34.5	77.1	1439.4	6	Increasing
Red River-1	12.0	2.5	12.3	26.8	104.2	1372.5	10	Increasing
Red River-2	21.5	10.7	9.7	41.9	114.5	1983.3	10	Static
Red River-3	7.4	19.8	4.8	32.0	69.4	1127.1	6	Static
Average	16.0	8.6	11.2	35.8	99.7	1695.7	-	Increasing
District Summary								
Elk City	13.6	4.4	9.9					Increasing
Red River	16.0	8.6	11.2					Increasing
Forest Summary	15.1	7.0	10.7					Increasing

Table 19.--Lodgepole pine killed/acre during 1980-82 and predicted trend for 1983, Craig Mountains, Bureau of Land Management, northern Idaho.

Area	Trees killed/acre 1980	1981	1982	Total	Predicted mortality T/A	Vol. A (cu. ft.)	Years for mortality to occur	Predicted trend
Dog Cr.	15.2	30.5	25.9	71.6	117.8	1197.8	5	Static
Soldiers Meadows	4.3	3.4	3.6	11.3	66.9	916.7	10	Increasing
Soldiers Meadows 1	50.9	49.3	37.1	137.3	170.0	1649.7	5	Increasing
Webb Cr.	30.4	20.7	18.1	69.2	187.3	2312.1	8	Increasing
Average	25.2	26.0	21.2	72.4	135.5	1919.1		Increasing

REFERENCES CITED

Barrett, S. W., and B. M, Kilgore. Fire history and management in Glacier National Park. Paper presented at NW Scientific Conf., Olympia, WA. 11 pp. 1983.

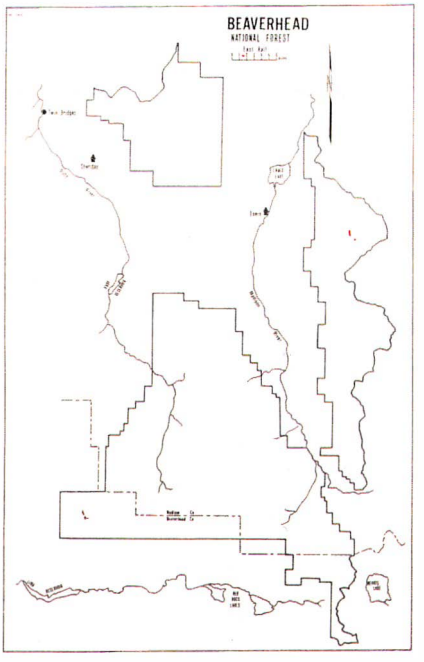
Canada/U.S. Mountain Pine Beetle Executive Summary. USDA Forest Serv., Washington, D.C. 72 pp. 1983.

Evenden, J. C. and A. L. Gibson. A destructive infestation in lodgepole pine stands by the mountain pine beetle. Jour. of Forestry. 38: 271-275. 1940.

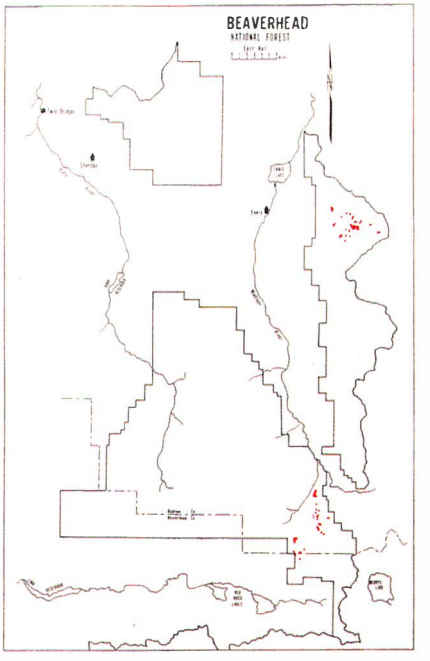
Evenden, J. C. Montana's thirty-year mountain pine beetle infestation. USDA Bureau of Ent. and Plant Quarn. Coeur d'Alene, ID. 23 pp. 1944.

McGregor, M. D. Proc. of the joint Canada/USA workshop on mountain pine beetle related problems in western North America. Canadian Forestry Service. Environ. Canada, PFRC BC-X-230. 87 pp. 1982.

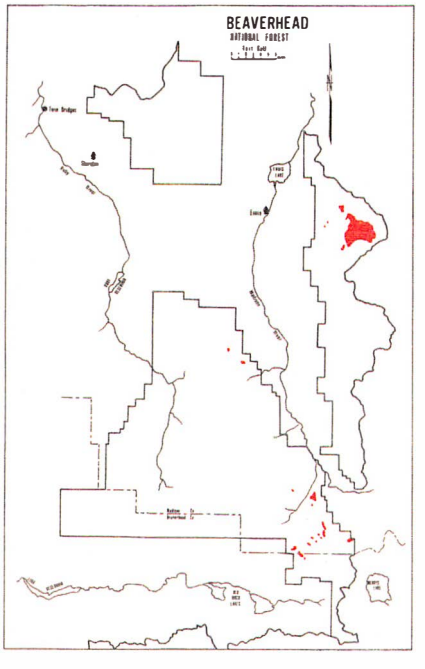
APPENDIX



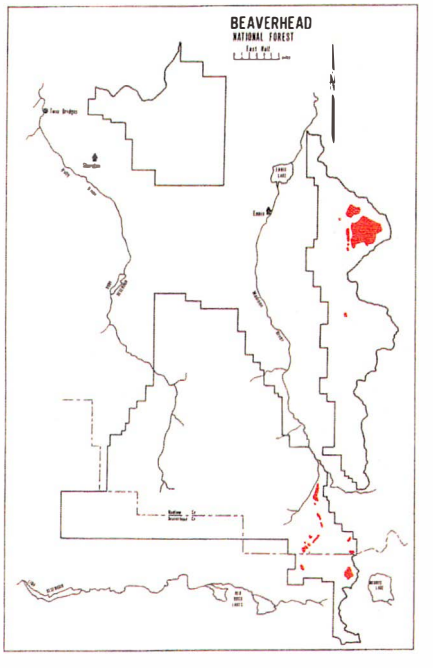
1973



1974

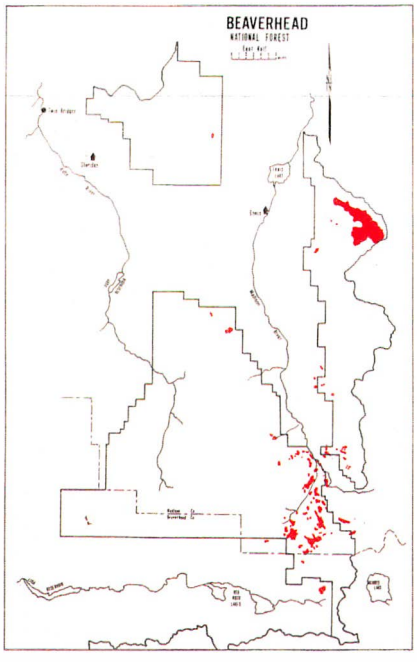


1975

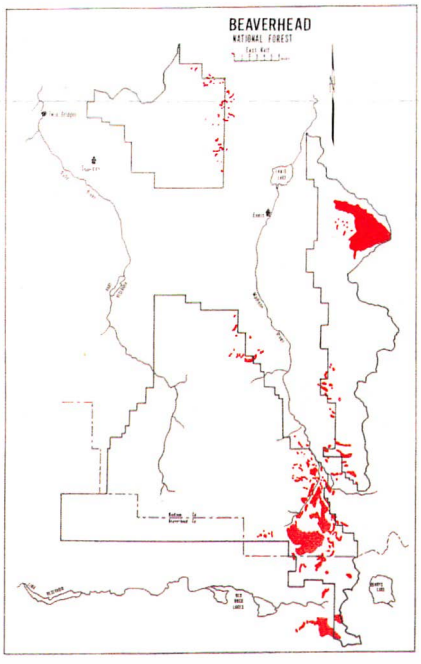


1976

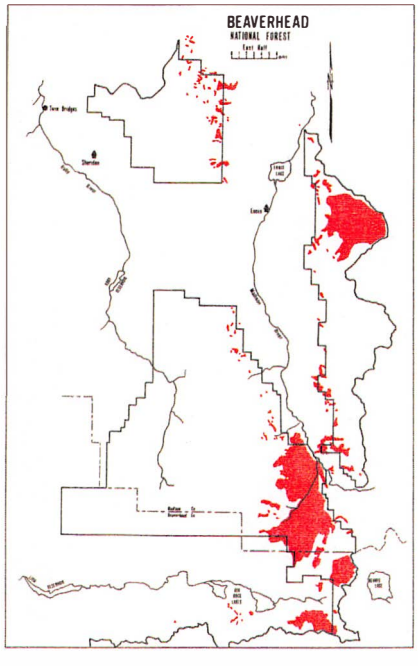
Figure 3.--Chronology of mountain pine beetle infestations, Beaverhead National Forest, and adjoining State and private lands, Montana, 1973-1982.



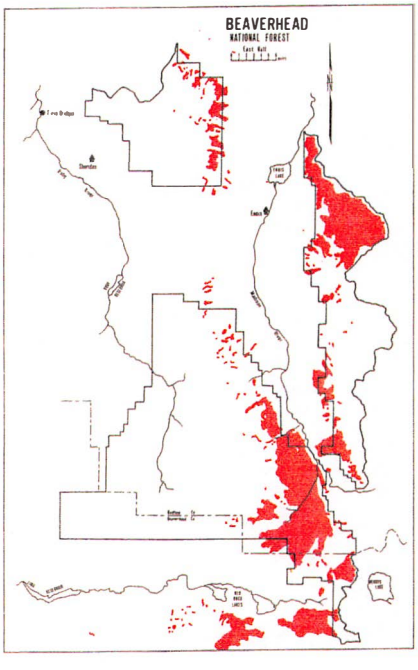
1977



1978

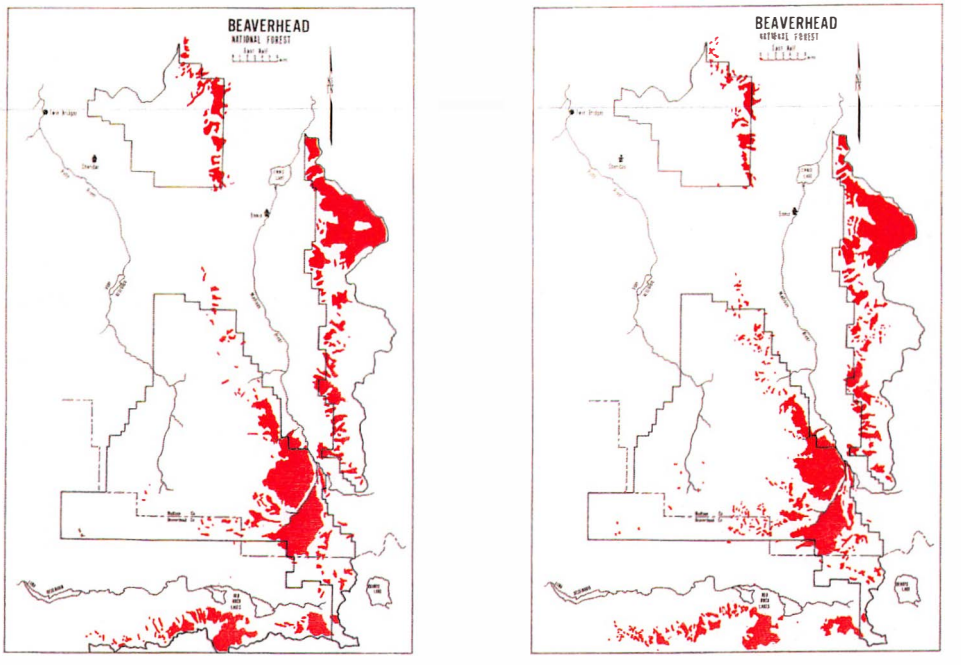


1979



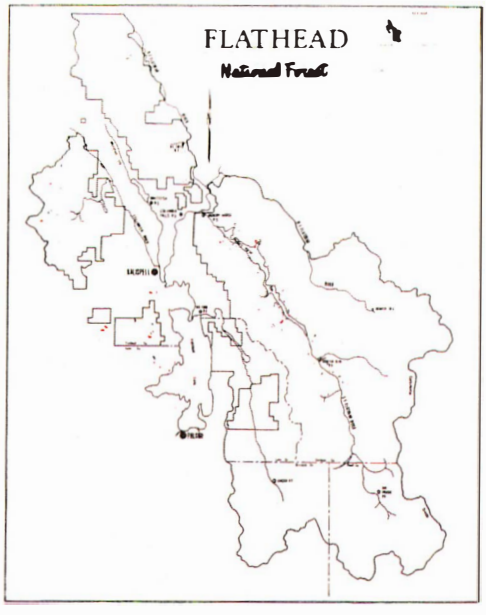
1980

Figure 3.--Chronology of mountain pine beetle infestation, Beaverhead National Forest, and adjoining State and private lands, Montana, 1973-1982, continued.

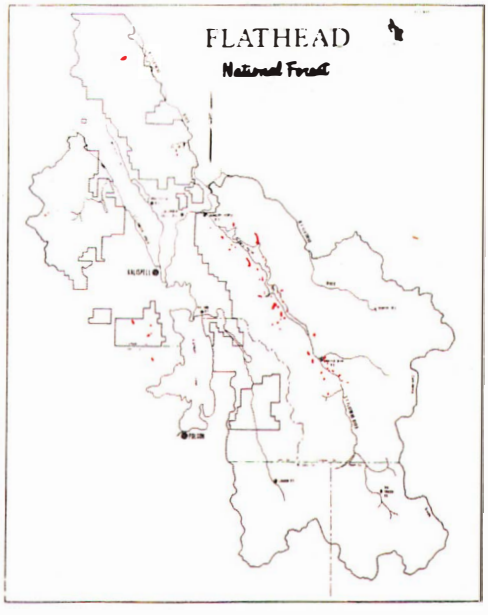


1981 1982

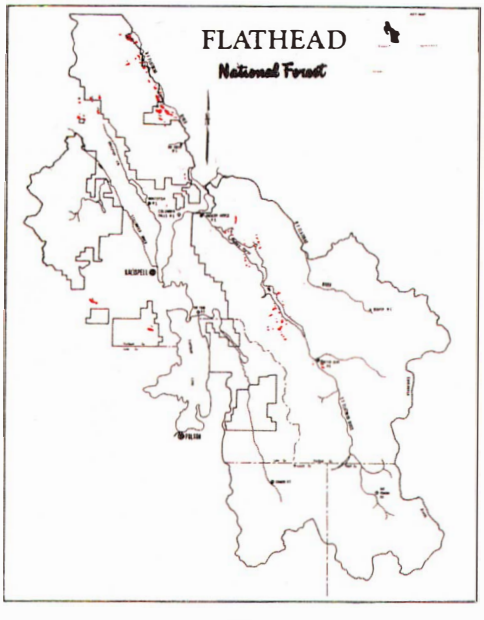
Figure 3.--Chronology of mountain pine beetle infestation, Beaverhead National Forest, and adjoining State and private lands, Montana, 1973-1982, continued.



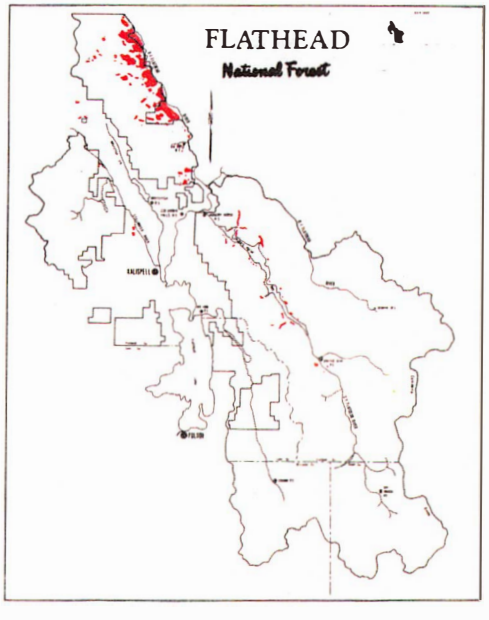
1974



1975

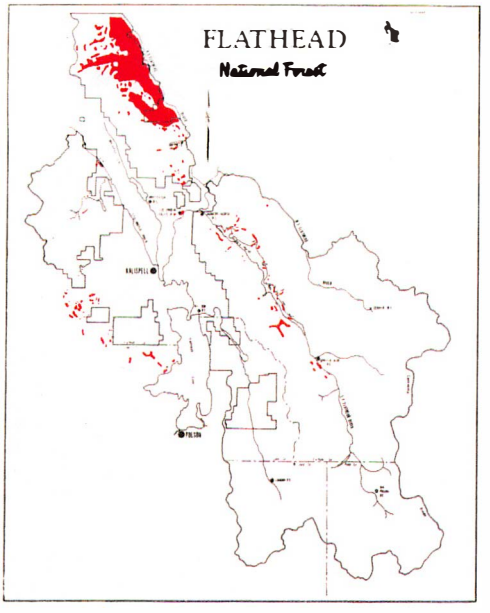


1976

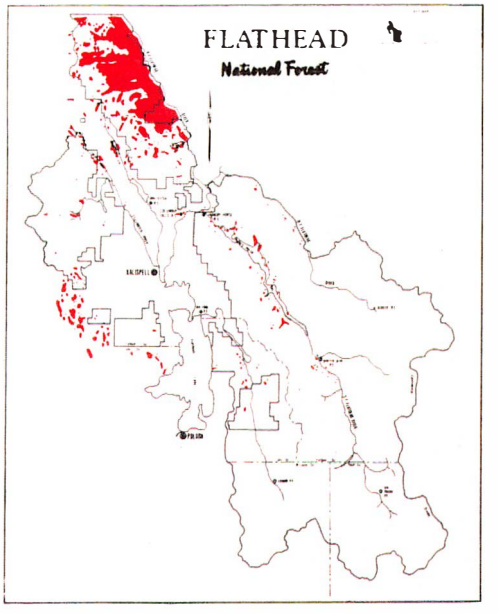


1977

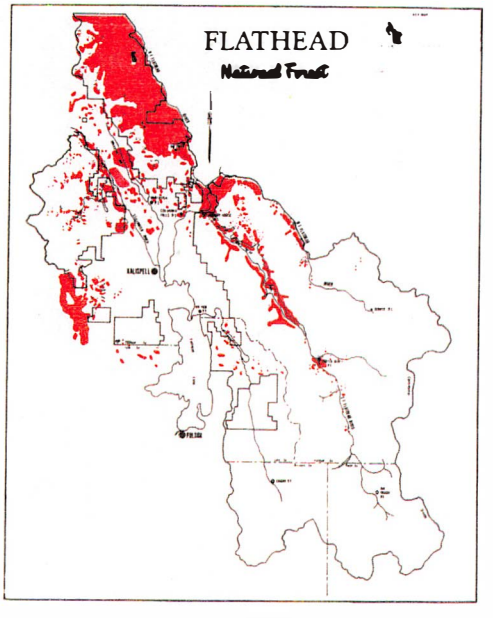
Figure 4.--Chronology of mountain pine beetle infestations, Flathead National Forest, and adjoining State and private lands, Montana, 1974-1982.



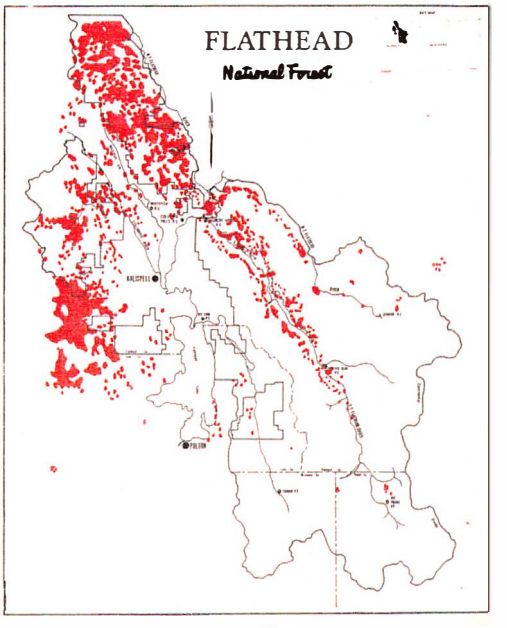
1978



1979

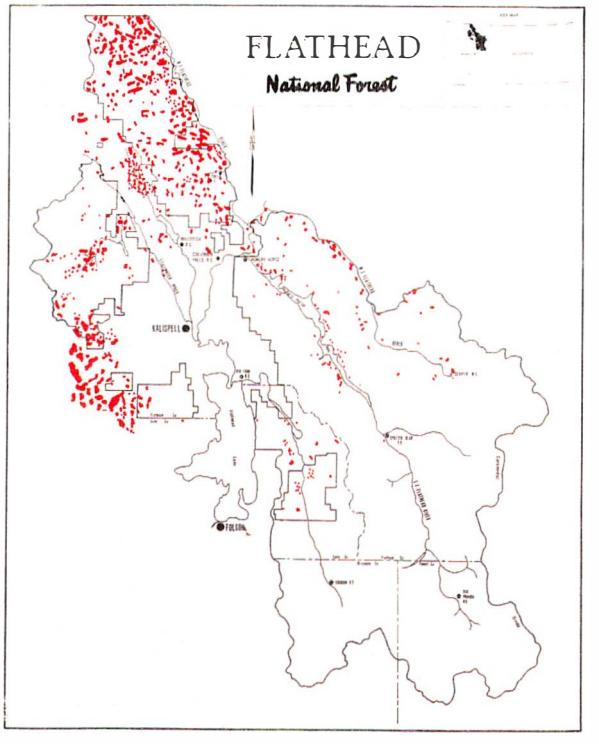


1980



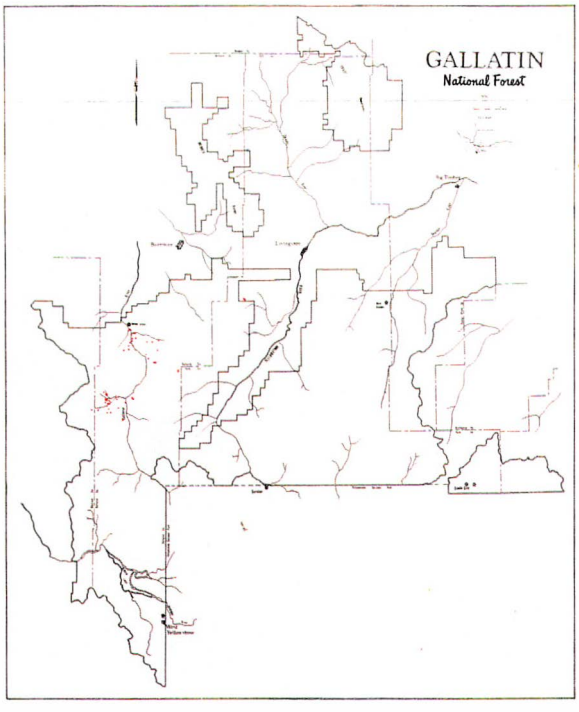
1981

Figure 4.--Chronology of mountain pine beetle infestations, Flathead National Forest, and adjoining State and private lands, Montana, 1974-1982, continued.

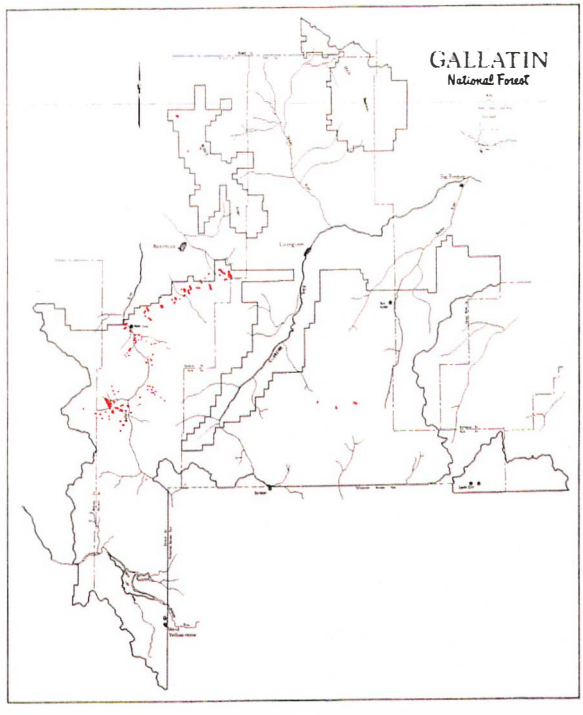


1982

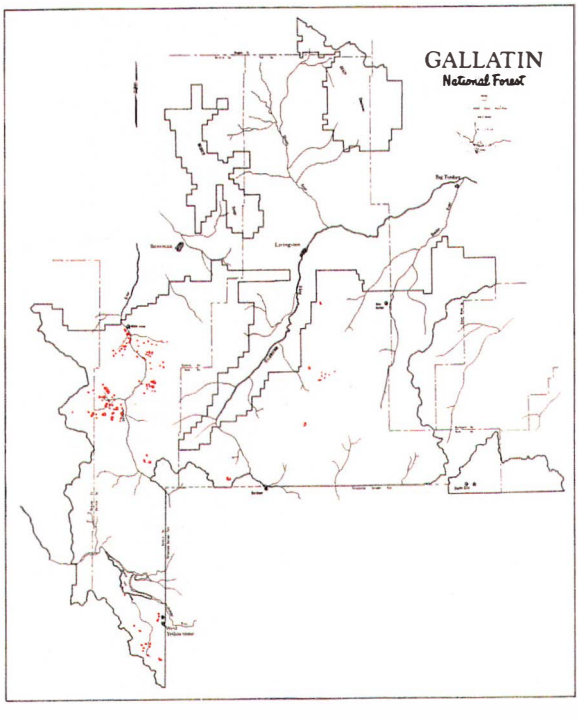
Figure 4.--Chronology of mountain pine beetle infestations, Flathead National Forest, and adjoining State and private lands, Montana, 1974-1982, continued.



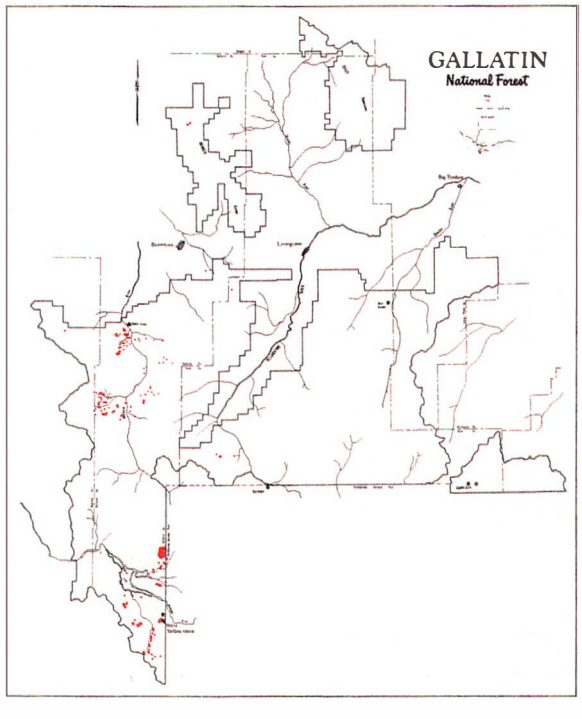
1970



1971

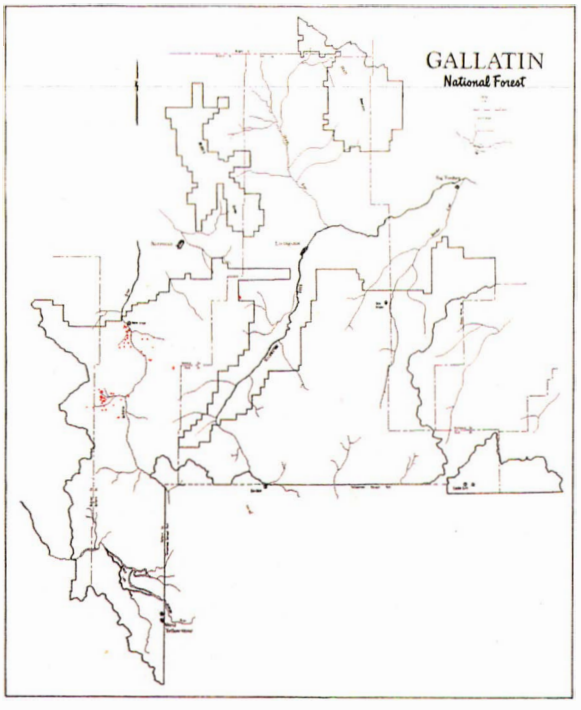


1972

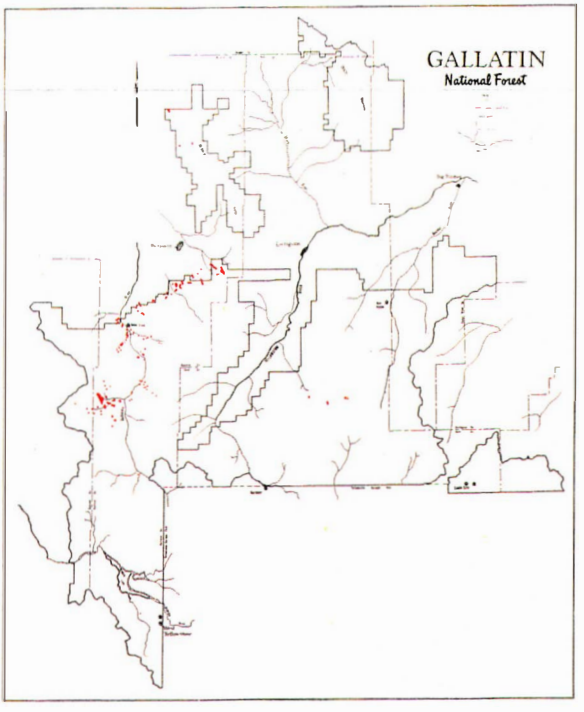


1973

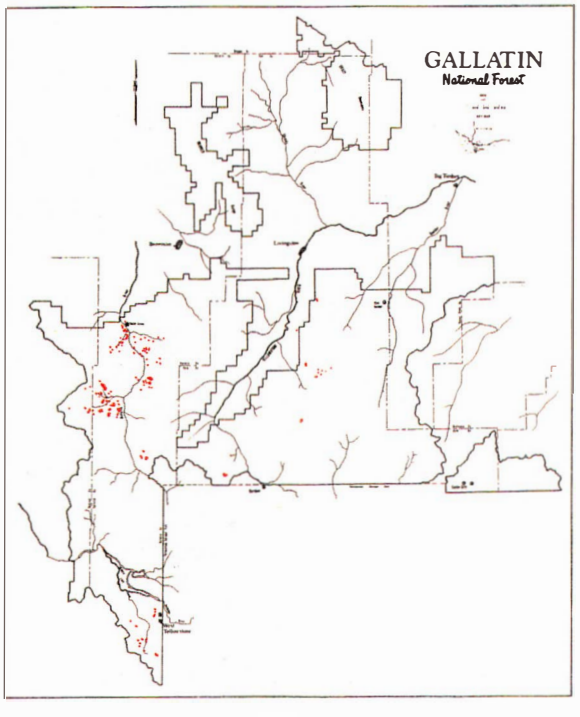
Figure 5.--Chronology of mountain pine beetle infestations, Gallatin National Forest, and adjoining State and private lands, Montana, 1970-1982.



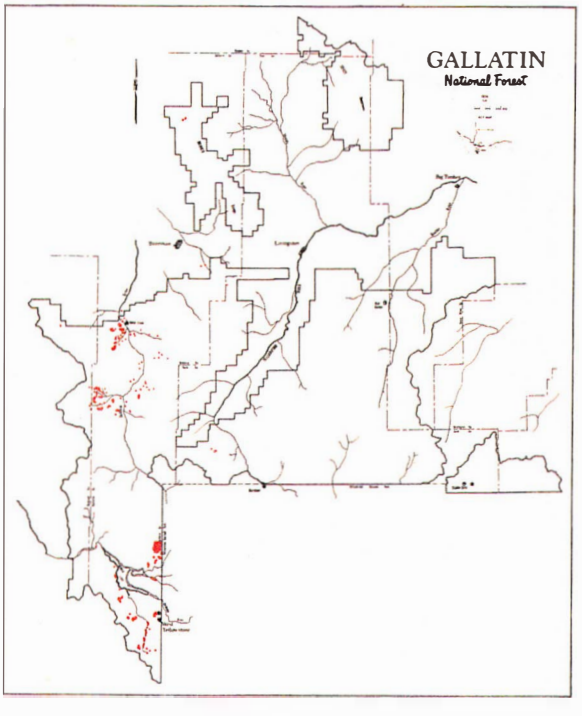
1970



1971

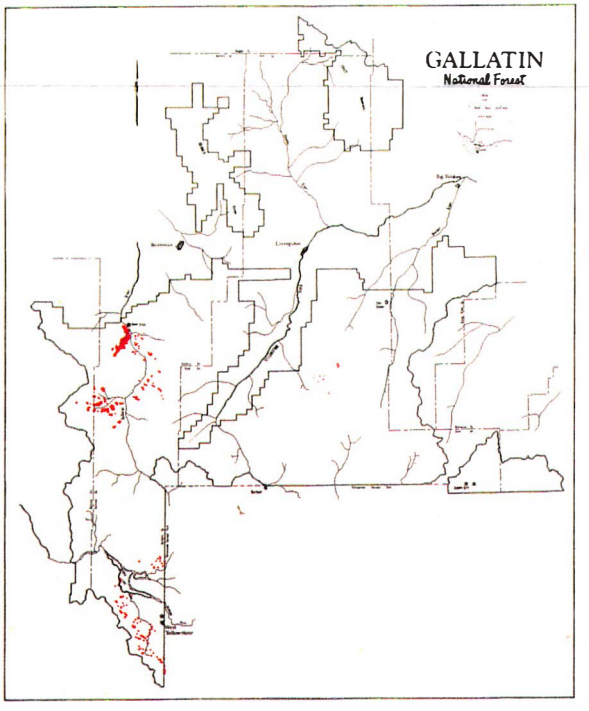


1972

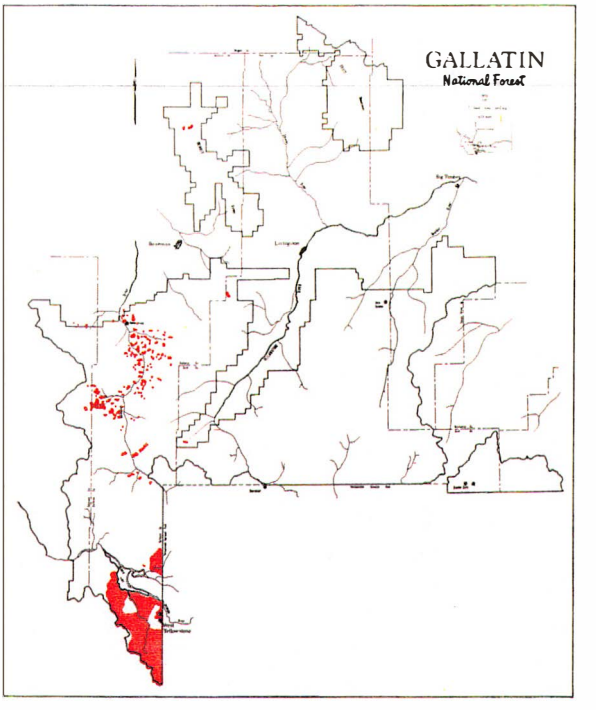


1973

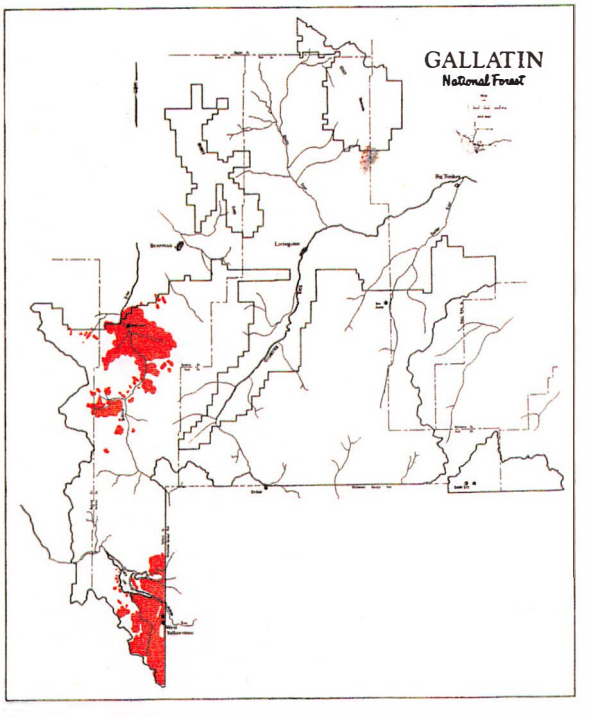
Figure 5.--Chronology of mountain pine beetle infestations, Gallatin National Forest, and adjoining State and private lands, Montana, 1970-1982.



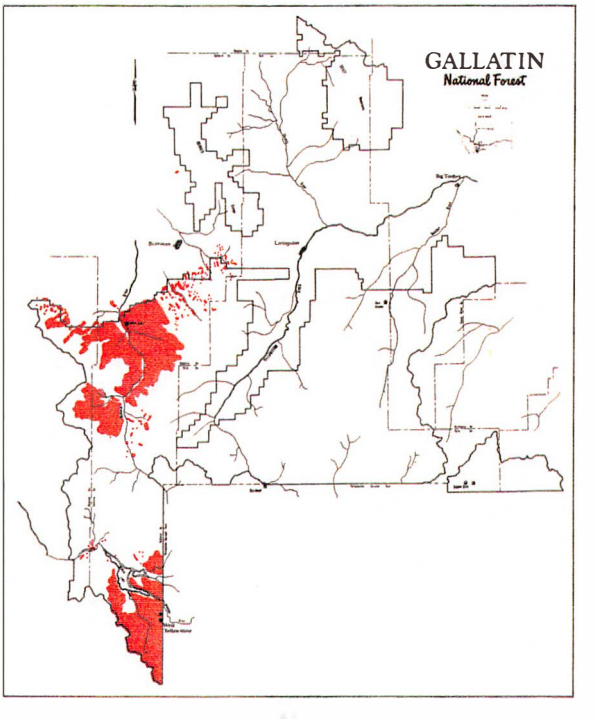
1974



1975

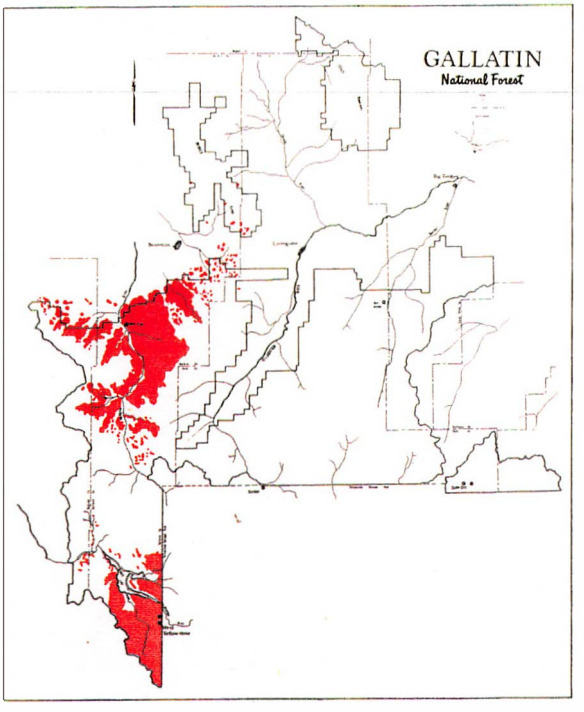


1976

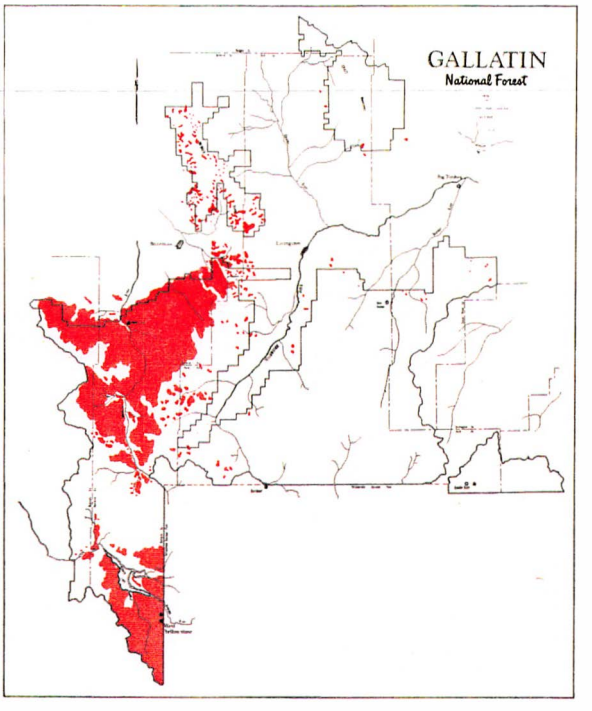


1977

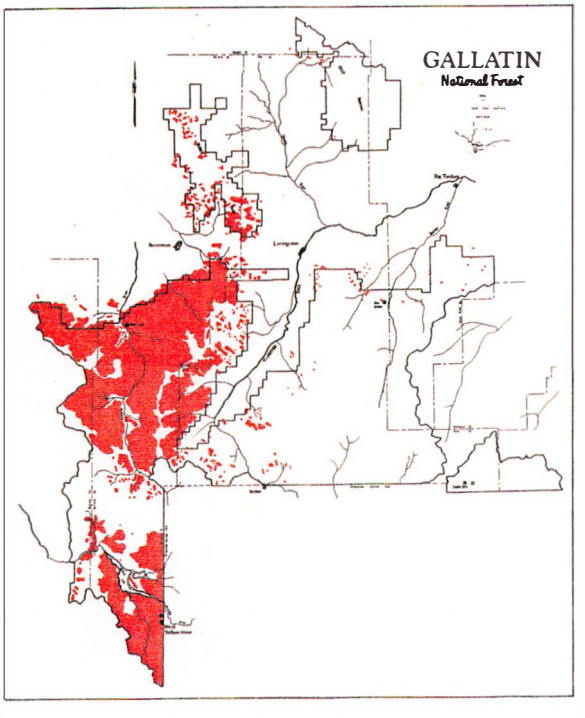
Figure 5.--Chronology of mountain pine beetle infestations, Gallatin National Forest, and adjoining State and private lands, Montana, 1970-1982, continued.



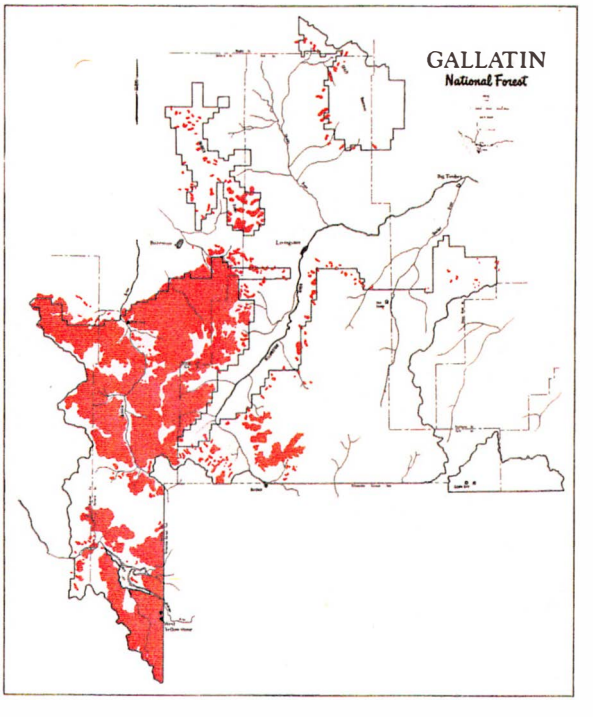
1978



1979

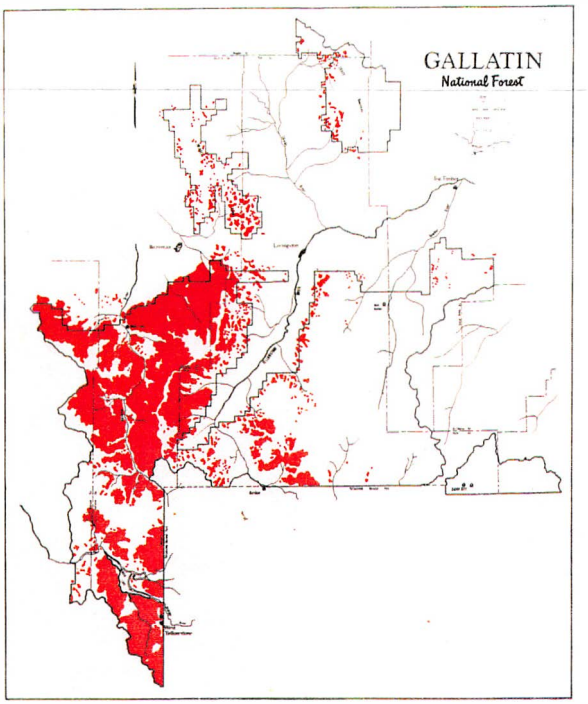


1980



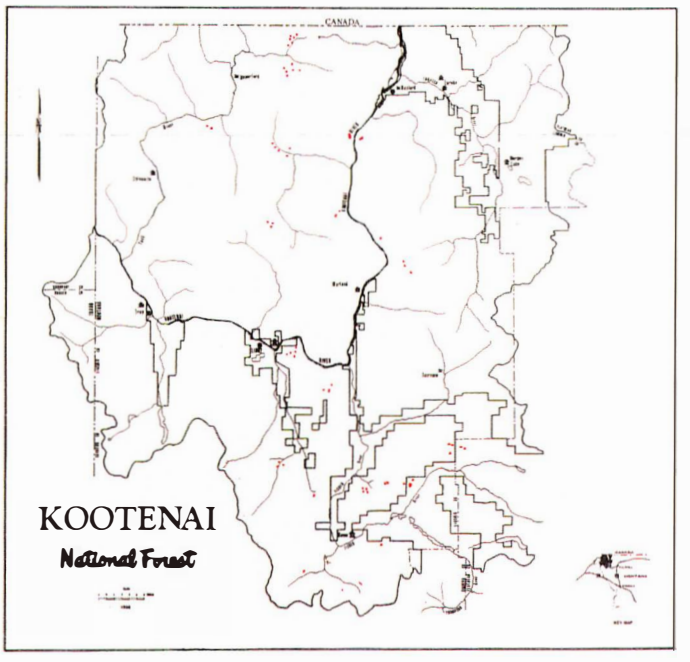
1981

Figure 5.--Chronology of mountain pine beetle infestations, Gallatin National Forest, and adjoining State and private lands, Montana, 1970-1982, continued.

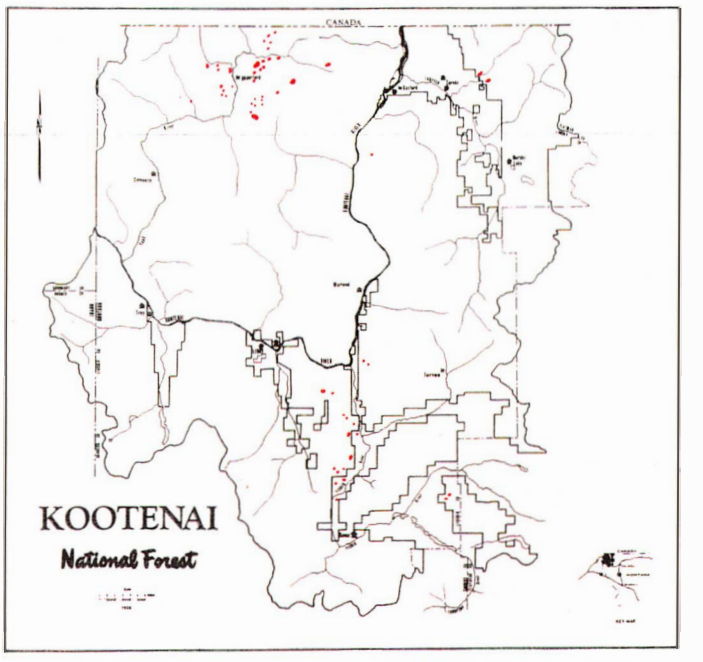


1982

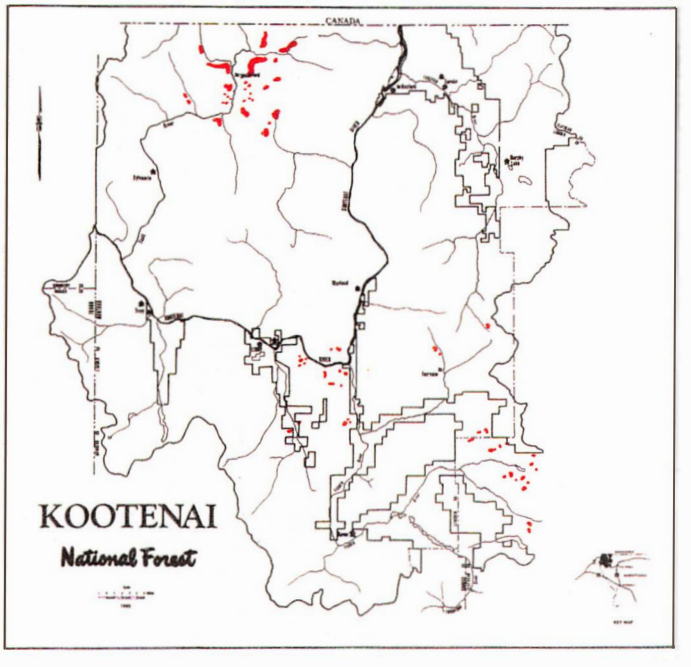
Figure 5.--Chronology of mountain pine beetle infestations, Gallatin National Forest, and adjoining State and private lands, Montana, 1970-1982, continued.



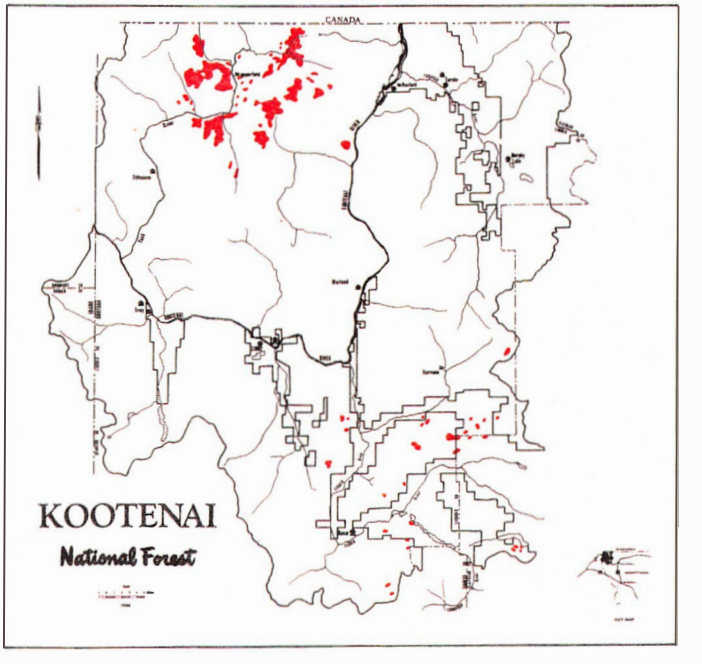
1973



1974

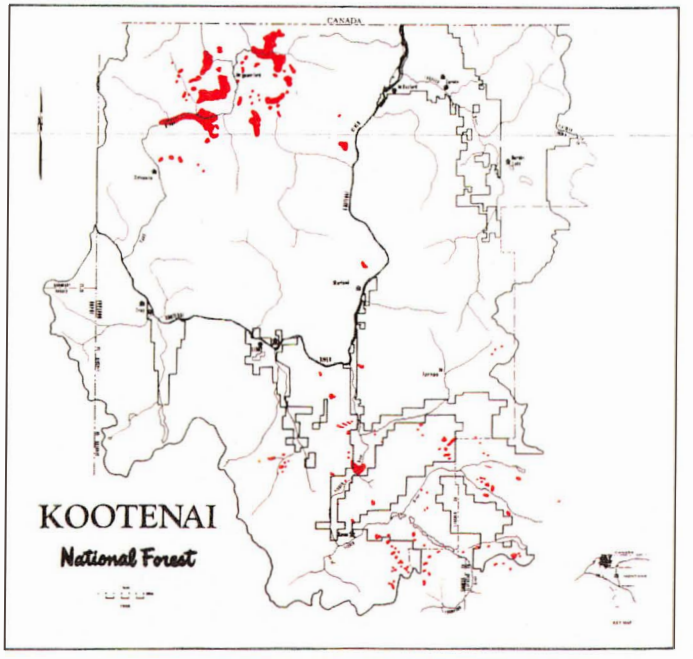


1975

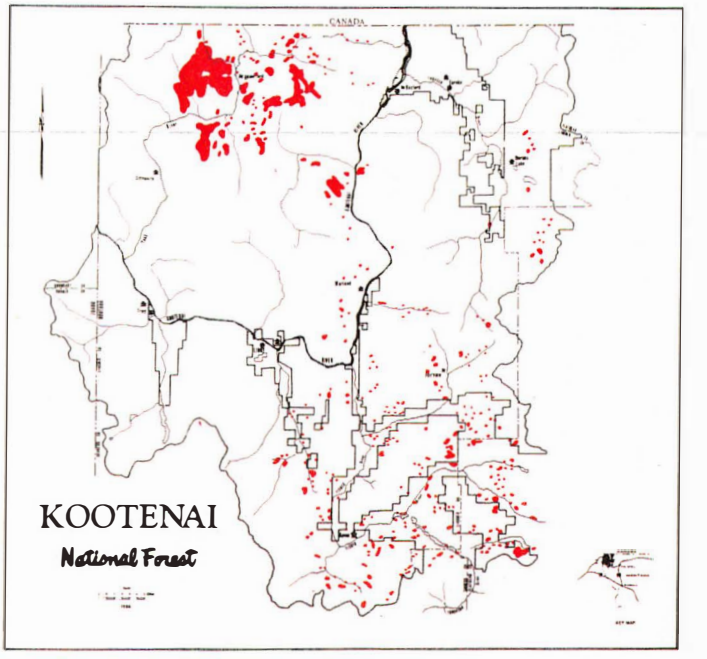


1976

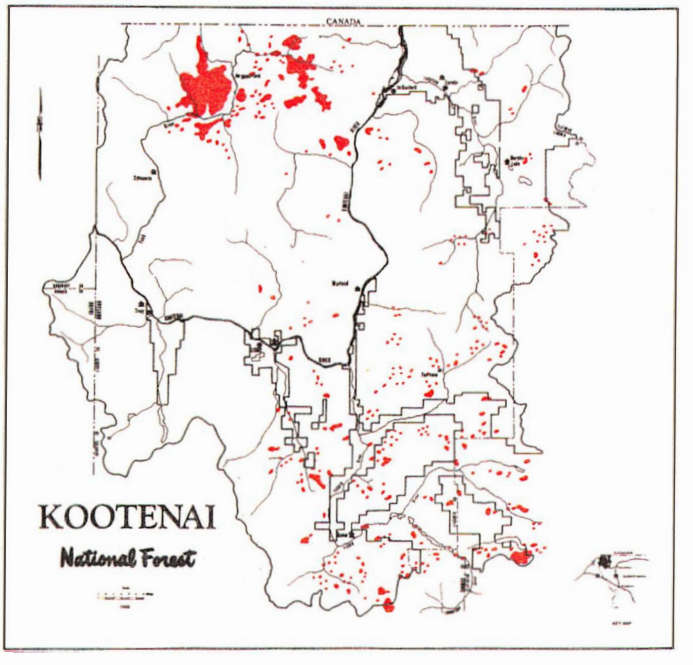
Figure 6.--Chronology of mountain pine beetle infestations, Kootenai National Forest, and adjoining State and private lands, Montana, 1973-1982.



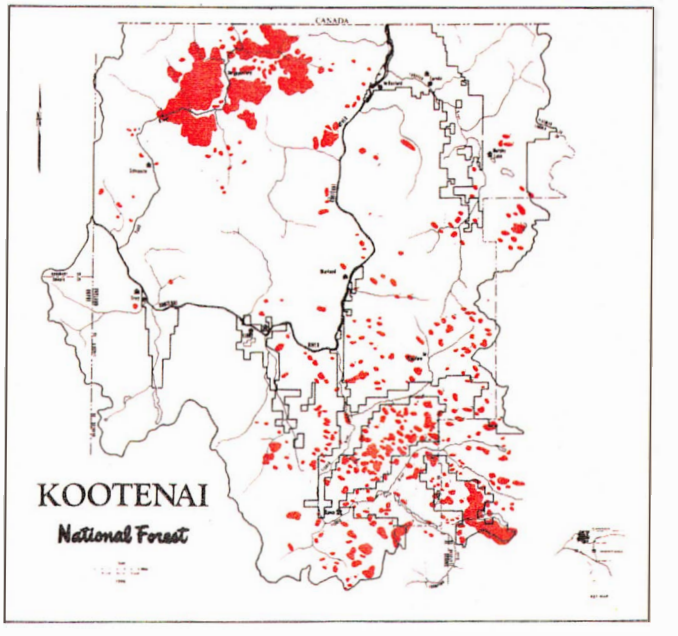
1977



1978

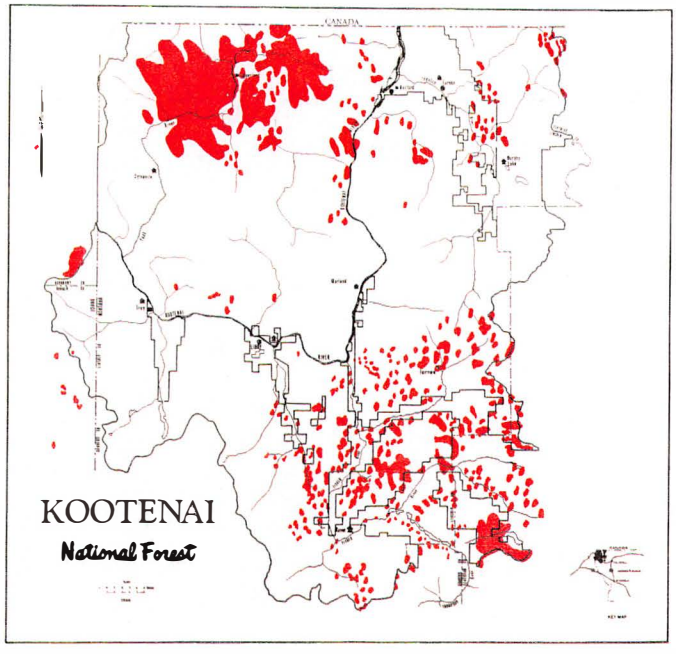


1979

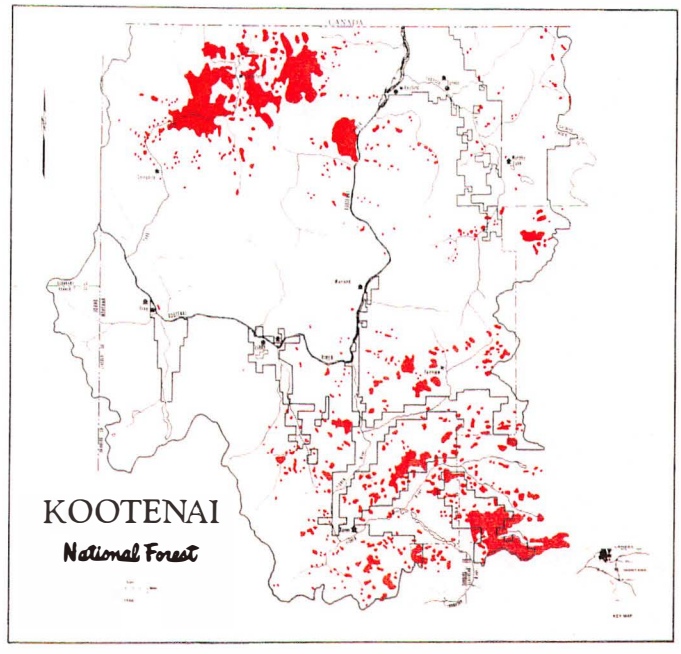


1980

Figure 6.--Chronology of mountain pine beetle infestations, Kootenai National Forest, and adjoining State and private lands, Montana, 1973-1982, continued.

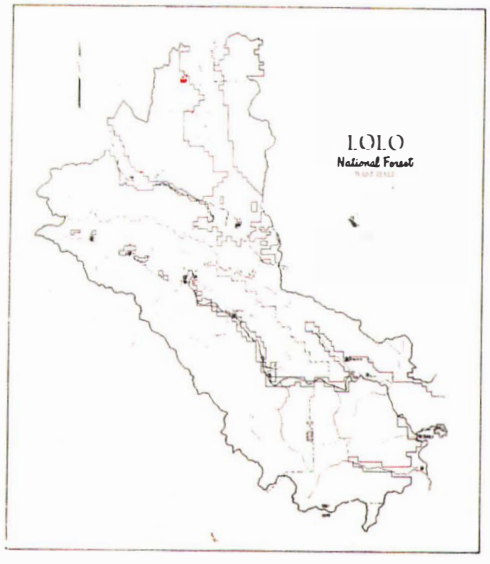


1981

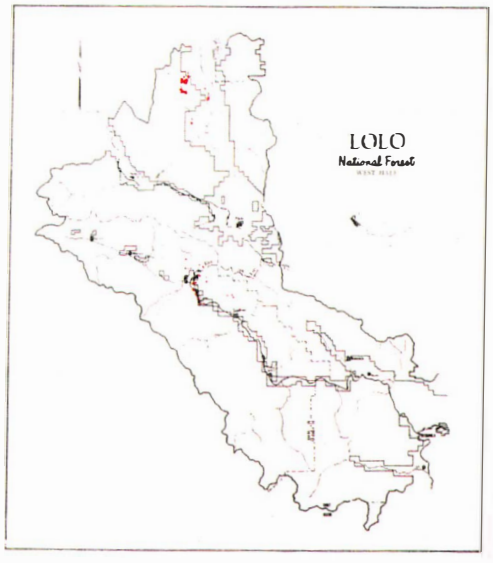


1982

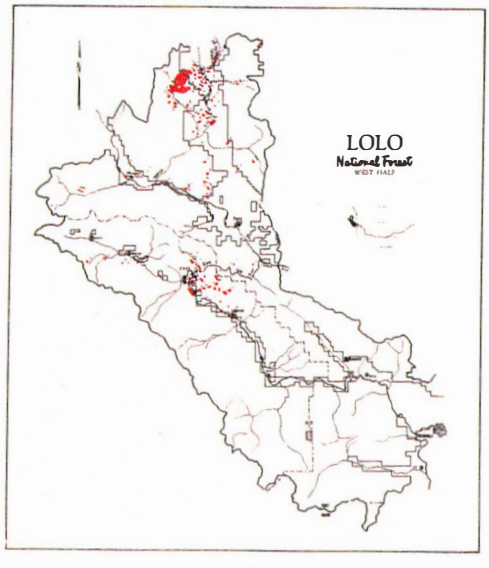
Figure 6.--Chronology of mountain pine beetle infestations, Kootenai National Forest, and adjoining State and private lands, Montana, 1973-1982, continued.



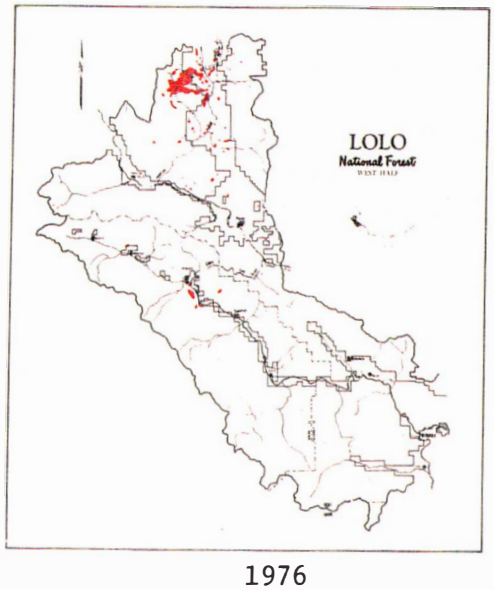
1973



1974

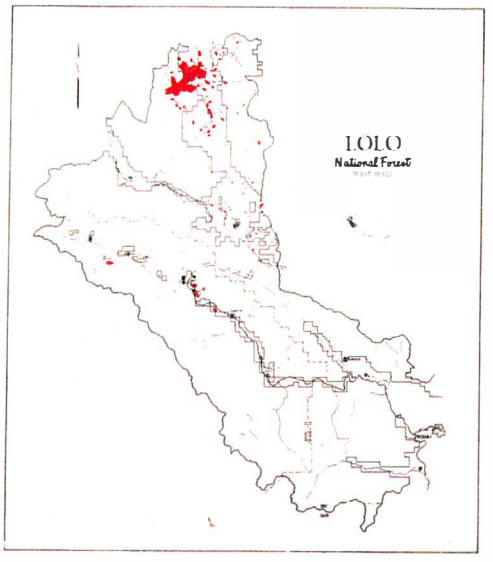


1975

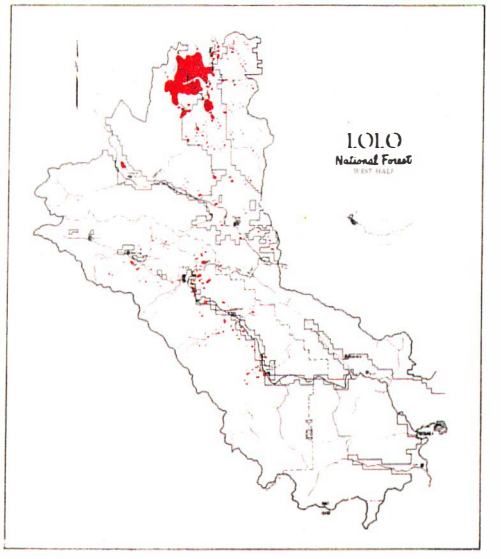


1976

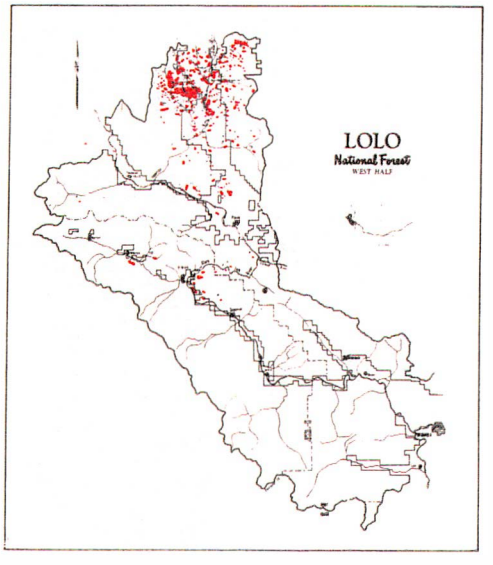
Figure 7.--Chronology of mountain pine beetle infestations, Lolo National Forest, and adjoining State and private lands, Montana, 1973-1982.



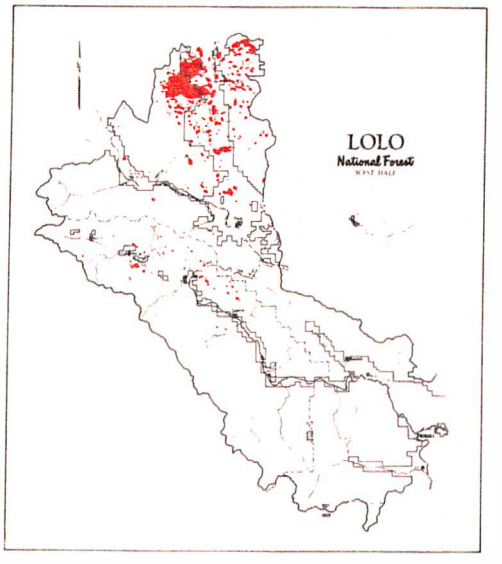
1977



1978

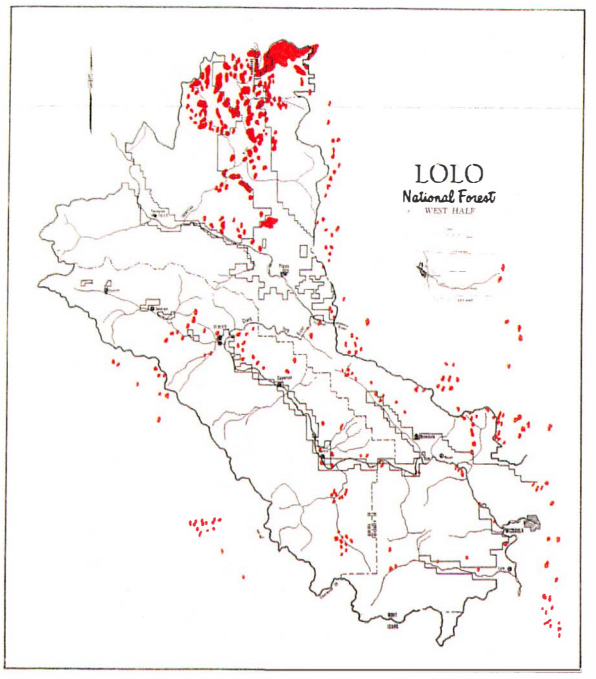


1979

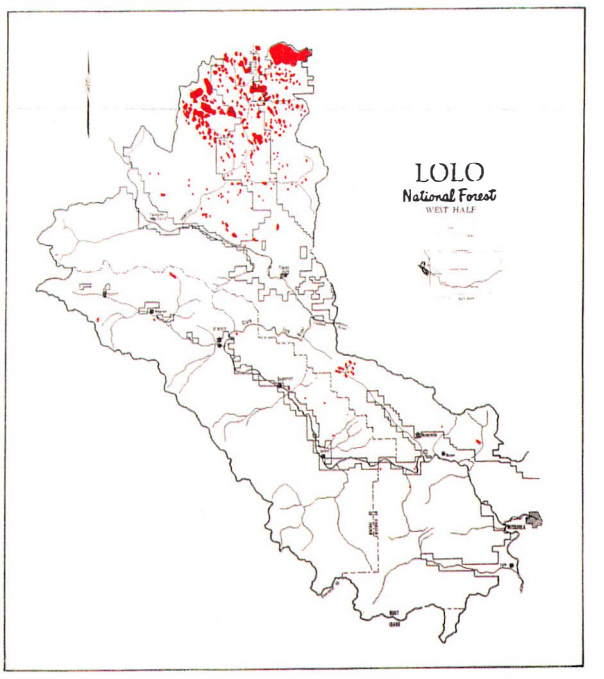


1980

Figure 7.--Chronology of mountain pine beetle infestations, Lolo National Forest, and adjoining State and private lands, Montana, 1973-1982, continued.



1981



1982

Figure 7.--Chronology of mountain pine beetle infestations, Lolo National Forest, and adjoining State and private lands, Montana, 1973-1982, continued.

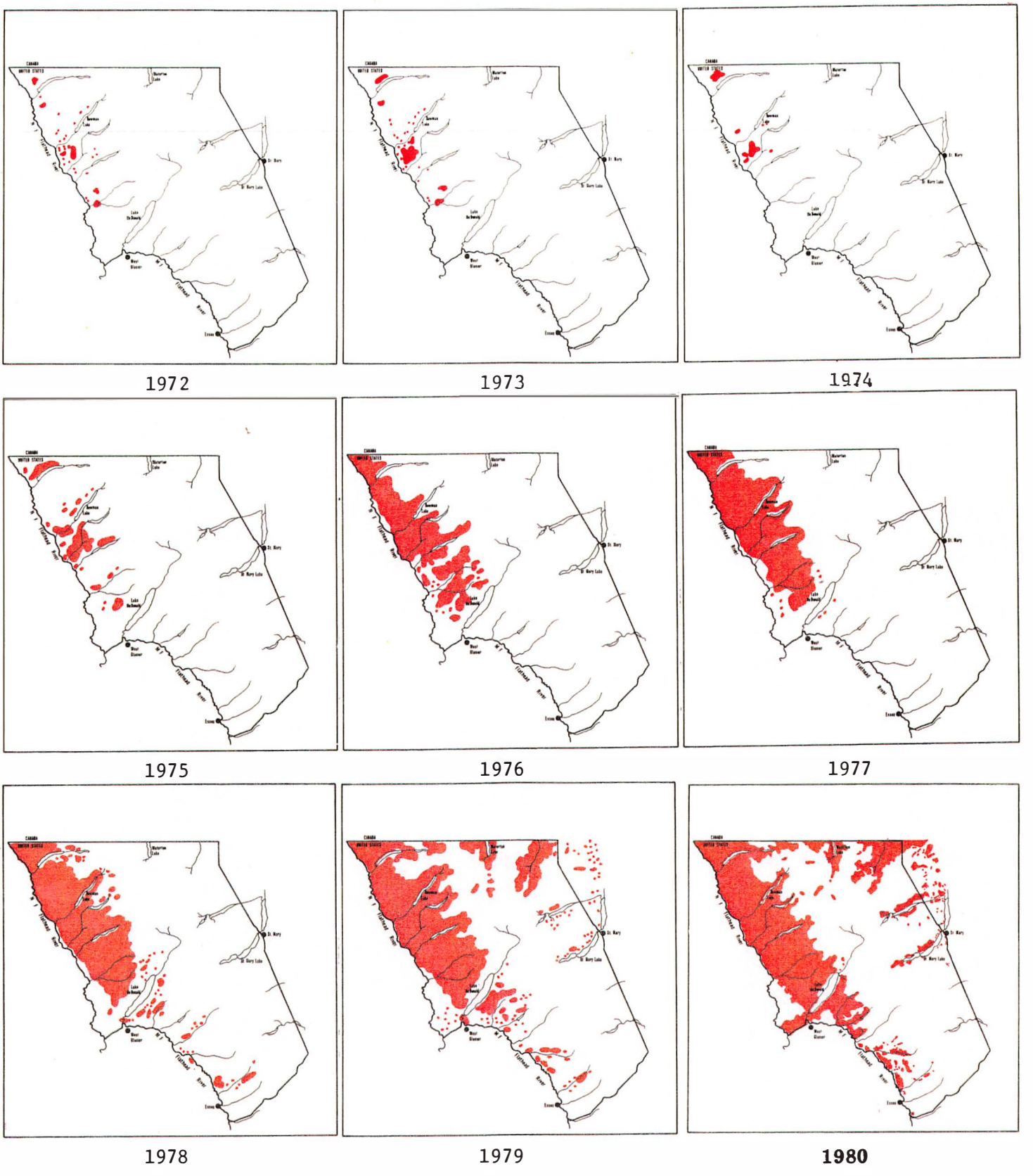
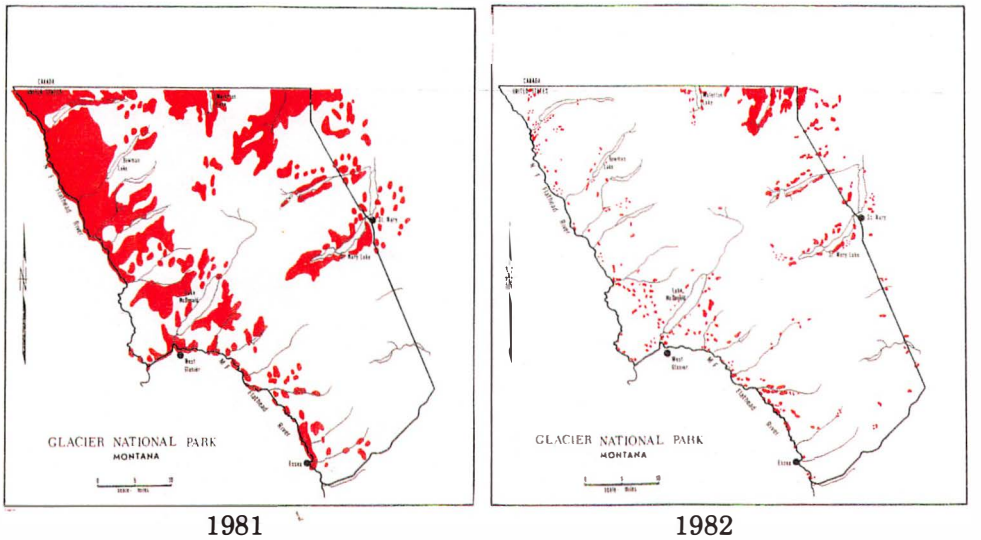
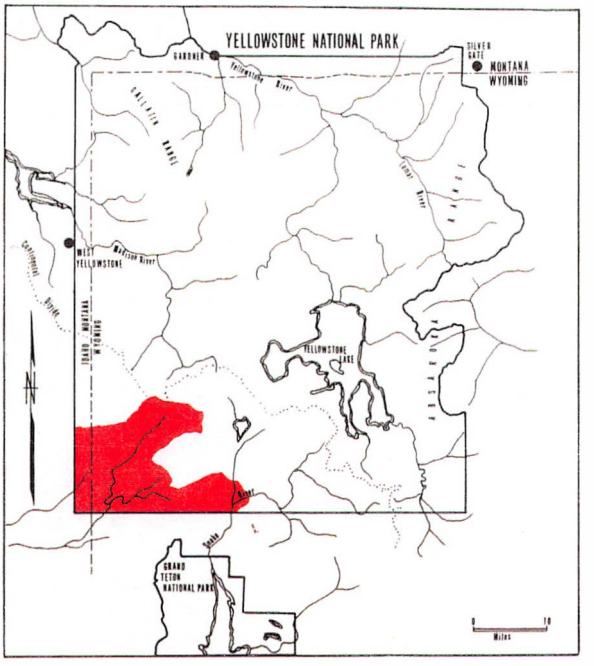


Figure 8.--Chronology of mountain pine beetle infestations, Glacier National Park and Blackfeet Indian Reservation, Montana, 1972-1982.

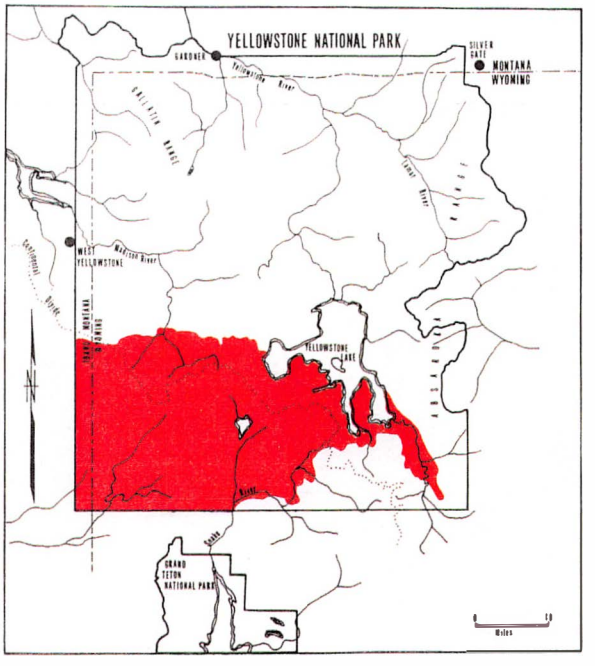


1981 1982

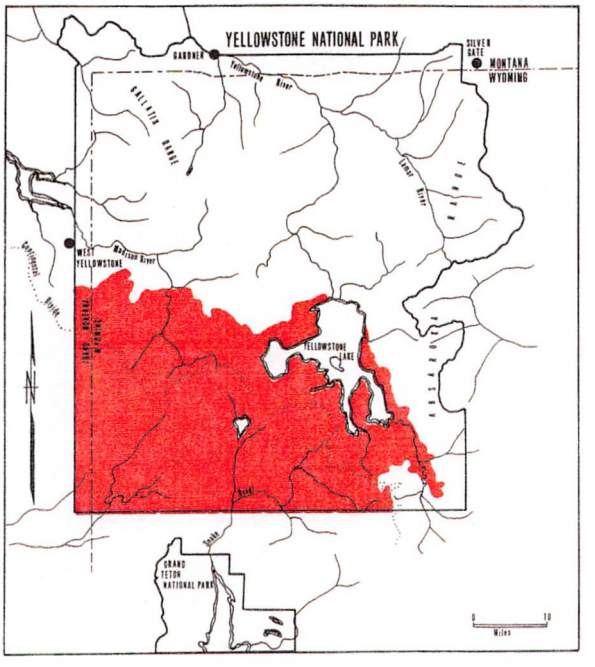
Figure 8.--Chronology of mountain pine beetle infestations, Glacier National Park and Blackfeet Indian Reservation, Montana, 1972-1982, continued.



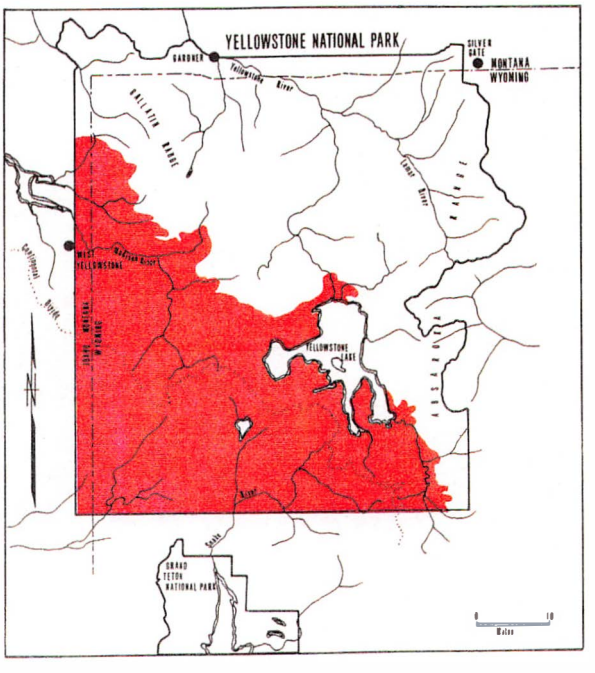
1970



1971

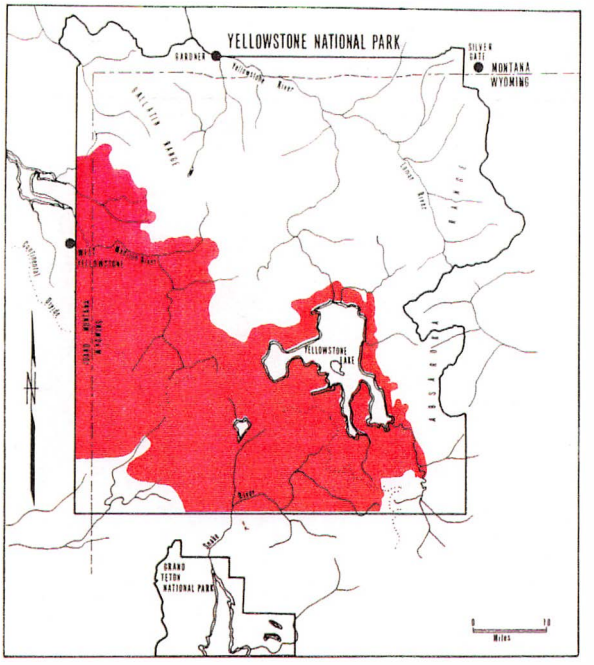


1972

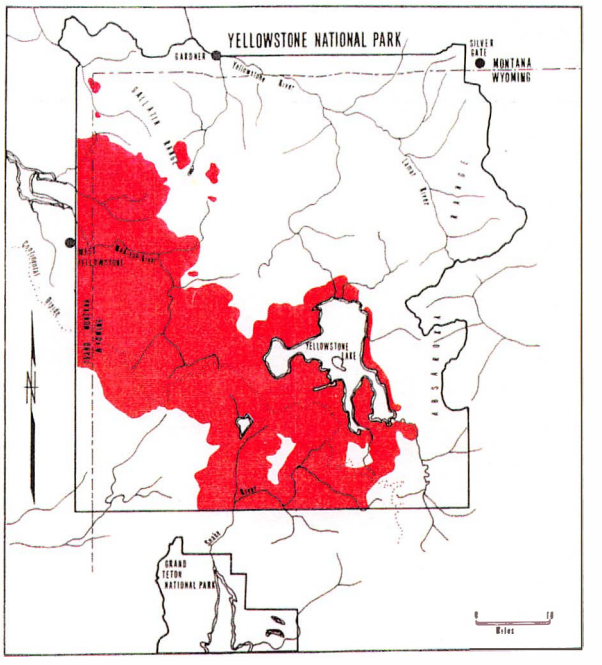


1973

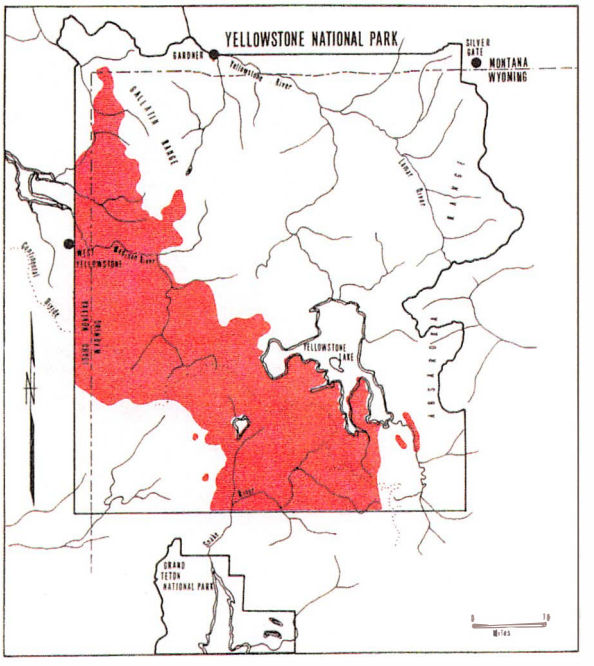
Figure 9.--Chronology of mountain pine beetle infestations, Yellowstone National Park, Wyoming, 1970-1982.



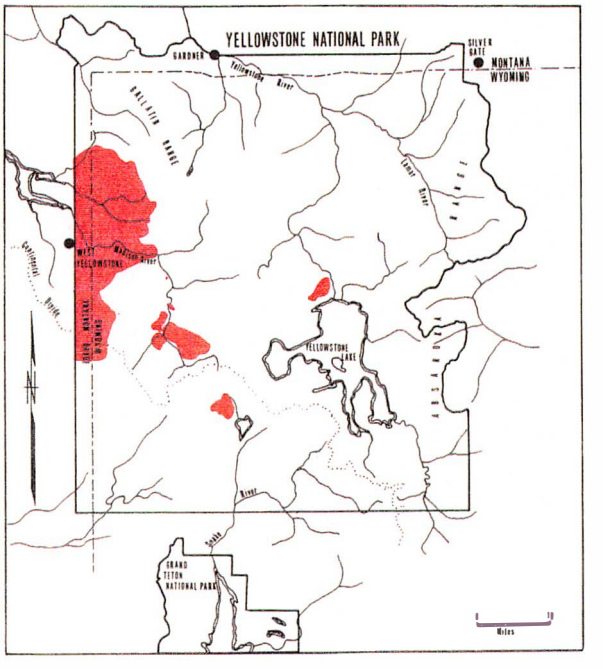
1974



1975

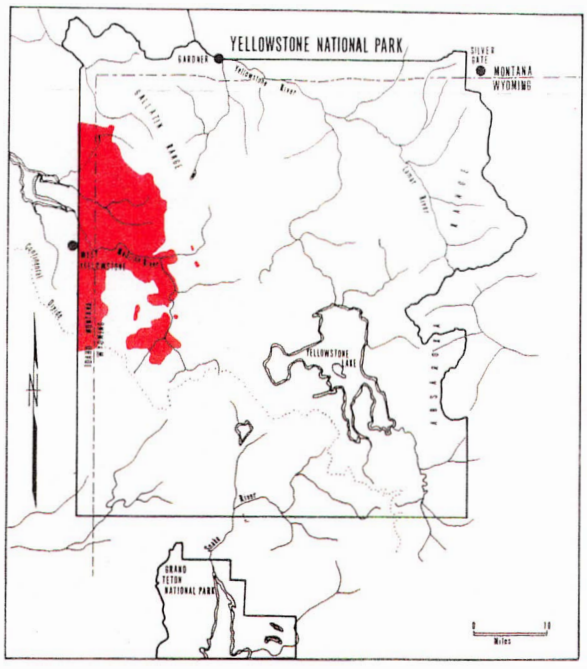


1976

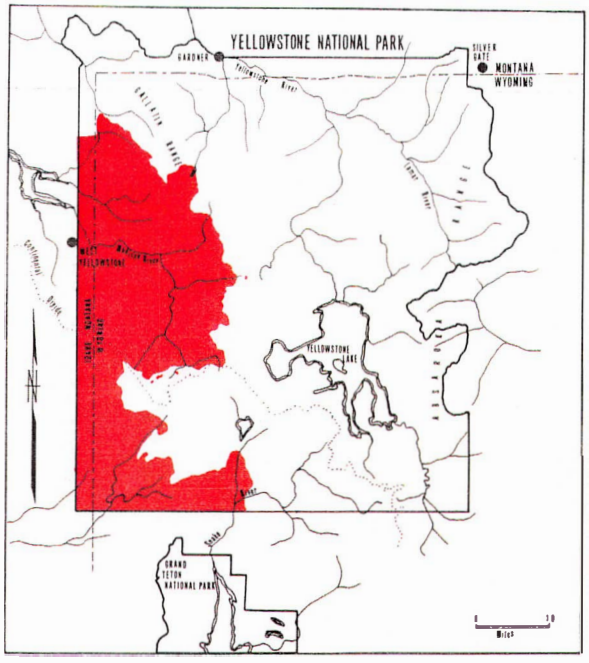


1977

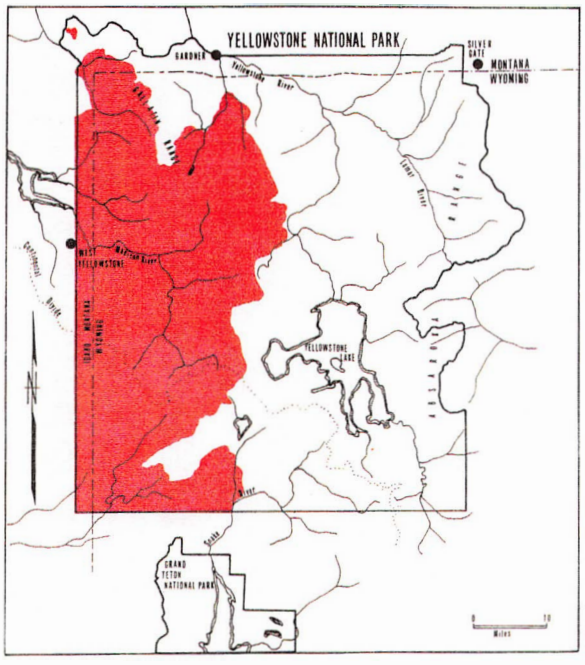
Figure 9.--Chronology of mountain pine beetle infestations, Yellowstone National Park, Wyoming, 1970-1982, continued.



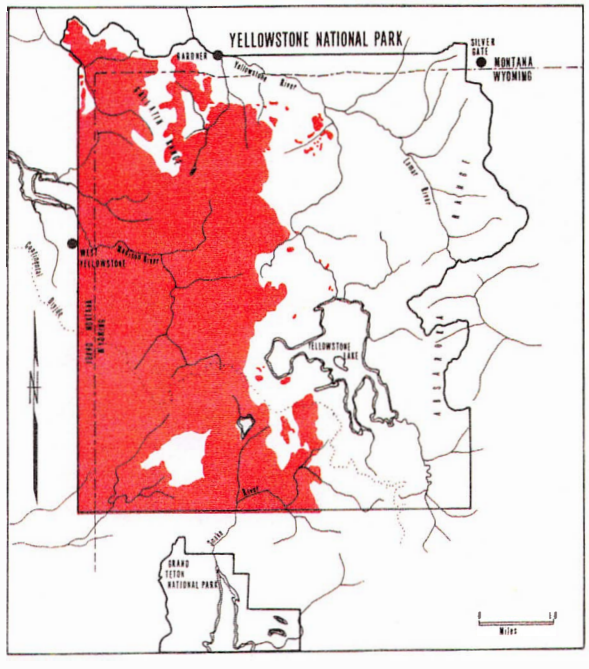
1978



1979

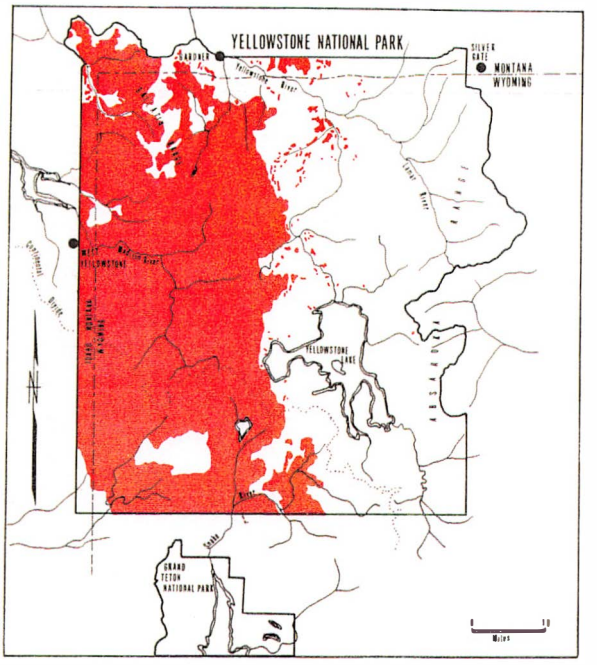


1980



1981

Figure 9.--Chronology of mountain pine beetle infestations, Yellowstone National Park, Wyoming, 1970-1982, continued.



1982

Figure 9.--Chronology of mountain pine beetle infestations, Yellowstone National Park, Wyoming, 1970-1982, continued.